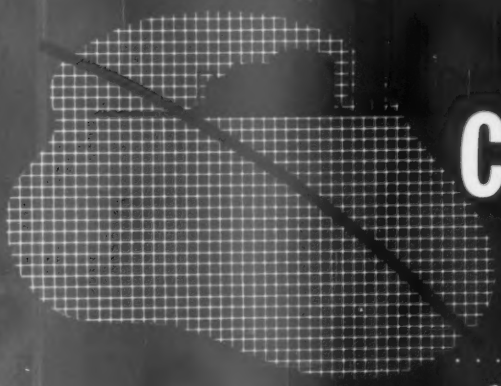
the OIL AND GAS JOURNAL
PUBLISHED WEEKLY AUGUST 29, 1960



A NEW LOOK AT THE

Constant % Decline/Curve

. . . explains some long-standing discrepancies. Serious errors can result if loss-ratio method is not applied very carefully p. 67

Mobil, Esso take fun out of price wars ▸ 45

Tanker surplus will be around for a while ▸ 48

Product stocks make August look like March ▸ 54

Product-pipeline terminal remotely controlled ▸ 75

More accuracy from freepoint indicators ▸ 93

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OIL AND GAS JOURNAL
Vol. 58, No. 35

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TECHNOLOGY—OPERATION

Drilling-Production

A New Look At The Constant Per Cent Decline Curve 67

By K. E. Gray

This article explains some long-standing discrepancies. The usual definition of decline is not the actual decline involved in the constant per cent decline curve. For constant per cent decline, the loss ratio for 1 year or 1 month is widely used as yearly or monthly decline respectively. Unless the loss-ratio method is applied very carefully, serious errors can result.

Reservoir Engineering—26 74

By E. T. Guerrero and F. M. Stewart

How to find interstitial-water saturation from analysis of oil-base-mud cores.

Today's Drilling Requires More Accuracy From Freepoint Indicators 93

By John N. Donhaiser

The accurate freepoint indicator is more important than ever before because wells are drilled deeper and drill-collar strings are longer. Thus the freepoint indicator needs greater resolving power at a time when inside bore of drill strings is often smaller than in the past. Here is an article which will bring you up to date on the latest models, how they work, and how they perform in the field.

Oil-Well Pumping—12 97

By Joseph Zaba

More on properties of sucker rods.

Pipelining

Product-Pipeline Terminal is Remotely Controlled 75

By D. T. Durrant

Turbine meter is used for local measurement, flow control, and remote telemetering of flow rate. Terminal makes heart-cut deliveries from 30,000-100,000-bbl. batches. Success of installation is basis for construction of second unattended terminal.

Pipeline Construction Report 104

Refining

Pipeline Delivers Sulfuric Acid to Refinery 78

By Kendrick D. Fetrow

System at Cities Service's East Chicago, Ind., refinery replaces tank-truck delivery. It has cut maintenance and transportation costs considerably.

Gas-Processing Plant Has Interesting Features 79

New Warren Petroleum-operated plant near Bridgeport, Tex., uses direct thermal stripping, fractionating lean-oil still, hydraulic recovery unit, and absorption-oil presaturator.

H-Oil Process Improves Quality of Distillate Feed 80

By M. C. Chervenak, E. S. Johanson, C. A. Johnson, S. C. Schuman, and M. Sze

This new hydrogen-treating process mixes oil and hydrogen in an ebullating bed of catalyst. Good contacting of oil, hydrogen, and catalyst, and good lateral distribution of reactants result.

Wax Technology Faces Some Changes 89

By Kenneth W. Brooks

More complete separation of wax components, modification of functional properties of wax, and new measures of quality are avenues of improvement.

Foremans Page 101

Here are A, B, C's of organic and inorganic compounds.

Process Costimating—78 103

Product yields over the years indicate changing requirements.

The OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
August 29, 1960

Crude is tight, and the lid is on through September:

The 8-day producing pattern in Texas and production curbs in other prorated states are helping dry up supplies of crude. High refinery runs are doing the same to stocks.

Speculation is that:

...Crude prices will firm up. Ohio Oil has already restored cuts made some months ago in the Illinois basin and southern Michigan.

...Refiners may be forced to cut runs. Their storage is dwindling and they're unable to pick up supplies in the spot market.

...Buying in the spot products markets may pick up if Texas keeps the 8-day pattern in October (p. 46)*.

▼ ▼ ▼

Abroad, the crude picture is less bright.

Heavy Neutral Zone crude is being offered at lowest posted price in history when Getty posted $1.27 a bbl. for 16.5-17.4° gravity Eocene oil, 3-cent cut (p. 65).

In Venezuela, Sun and Superior, two newcomers to Lake Maracaibo production, are guinea pigs in a tussle on prices. They are walking a tight rope trying to sell their crude at a price high enough to avoid a government crackdown (p. 66).

The standard 50-50 profit split in the Middle East may be at stake in talks going on between Iraq Government and the Iraq Petroleum Co. Government is challenging the old formula as being outdated by Persian Gulf contracts (p. 63).

▼ ▼ ▼

Both political parties are seeking—at least until November elections—to prove they are friends of oil.

Example: Republicans circulate word that oil men should support GOP if they don't want percentage depletion cut. The Democrats retort: "Democrats have controlled Congress for all but a very few years since this incentive was first adopted, and we haven't trimmed it a point yet."

---

*Refers to article in this issue giving more details. Where no page is given, the item is a Newsletter exclusive.

Regarding gas legislation, Democrats point to Eisenhower veto, but Republicans remind them that Truman, too, killed a gas measure.

On helium plant construction, Republicans plan to blame the Democratic policy committee if helium bill isn't passed in the current session.

There will be more of this sort of thing before November.

Military is keenly interested in experiments with use of air ducts in plane wings to reduce turbulence and friction. This might cut a plane's fuel consumption by as much as 50%, experts say hopefully.

Meeting of Foreign Petroleum Supply Committee to set up a readiness subcommittee to assist military in oil planning has been tentatively set for mid-September. Efforts for an earlier meeting ran afoul of vacations.

▼ ▼ ▼

Wider well spacing will be an important factor in the proposed formula for fixing Louisiana's oil allowables.

Wells drilled in new pools on a spacing pattern of more than 40 acres would get an allowable progressively greater than the one presently based solely on depth. Maximum boost would be 50% on spacing of 80 acres.

Arguments on the proposal will be heard September 28 before any permanent order is issued (p. 60).

Texaco has a real sleeper well in California's Sacramento Valley—a gas well that has started flowing oil (p. 53).

It's the first oil in the vally and is about 90 miles north of nearest oil production. Significance of the oil flow cannot be determined until further drilling is done.

Offshore Texas has an important wildcat coming up.

Shell is drilling a test 31 miles south of Galveston in Federal waters. Location is on a 5,760-acre tract that sold last February for nearly $6 million.

There have been very few big discoveries and only lukewarm interest in Texas offshore areas so far (p. 58).

West Central Texas producers are banding together to find and develop a bigger market for the area's gas.

The drive, launched by West Central Texas Oil & Gas Association, will focus initially on finding market outlets for shut-in wells in an area embracing primarily Palo Pinto, Parker, Stephens, Erath, Young, Comanche, Eastland, Brown, and Coleman counties.

Major marketers are moving to take the profit out of price wars and eliminate this deadly enemy of profits.

Efforts are centering around trying to restore wholesale prices as a dominant factor in retail pricing. Notable steps have been taken by Mobil with wide area tank-wagon pricing and Esso with a graduated zone-pricing system (p. 45).

Signal has introduced multigrade marketing to the Texas and Louisiana coastal area. Seven grades of gasoline are offered from a single pump at the 25 Signal stations in the area.

Gulf Coast marketers will watch the new move closely (p. 51).

Petrochemical construction projects in the U. S. have hit an all-time high this year of 118.

The Gulf Coast is increasing its stature as the chemical center with more than half of the new projects scheduled there. Major emphasis in the building is on production facilities for polyolefins, synthetic rubber, and styrene.

Western Europe also is busy with 91 new projects either planned or started.

▼ ▼ ▼

Coiled aluminum pipe has been transported from the mill, uncoiled at the site, and buried in a continuous operation.

The initial test used 2-in., seamless, wrapped pipe; but other sizes have ben tested successfully.

Pipeline construction will start this fall on the 1,404-mile gas system which will bring western Alberta gas into San Francisco and the Pacific Northwest (p. 47).

A 6.5% rate of return has ben allowed Midwestern Gas Transmission's pipeline project to serve North Central U. S. with Canadian gas.

Midwestern originally had requested a 7% return.

▼ ▼ ▼

Honolulu Oil Corp. definitely is up for sale. The San Francisco independent has sent copies of its balance sheet to selected companies and specifically invited bids by a certain date.

Oil-company stocks may be out of the doghouse with investors.

Standard & Poor's new analysis states that oil shares, after 2 years of subpar performance, now appear in position to act better relative to the market as a whole.

Market Memo

August 29, 1960

Continued heavy refinery runs and pile-up of inventories are tending to unsettle the products markets as the seasonal post-Labor Day slump in demand approaches.

Marketers are becoming nervous about prices of gasoline and middle distillates, although both continue to hold firm.

One hope is developing: Runs may be forced down by the tightening supply of crude. Refiners already are hunting for crude on the spot market but finding practically none.

Middle distillates out of Group 3 for northern shipment took an increase of one-half cent per gallon. They are now reported firm at their present postings of 10 cents for No. 1 and 9 cents for No. 2.

While inquiries are in the market for purchase of No. 2, refiners are not willing to offer discounts for a quick deal, even on small quantities. They still want a better look at the heating season.

Group 3 gasoline for northern shipment continues in good demand, but reports are being heard of discounts off the 12.5 cents posted price for 91-RON.

In Chicago, gasoline prices, posted at 12.675 cents for 92-RON and 15 cents for 99-RON, are firm.

The Chicago burning-oil market is very quiet with little activity and few summer fills having been made. No. 1 and No. 2 are firm in price at their respective postings of 10.25 cents and 9.5 cents per gallon.

At mid-river points on the Mississippi, inventories on all products are in good shape. Gasoline prices are "slipping" a shade. Offerings for spot housebrand gasoline range from 11 cents to 11.5 cents between Arkansas City and Memphis.

No. 2 continues in a firm position on the river—at one-quarter cent over Gulf Coast low posting of 8.25 cents per gallon.

The Gulf Coast products market is inactive but firm at current posted prices.

Gasoline is being nervously held for low Gulf Coast posted prices of 11.25 cents for 92-RON and 12.375 for 99-RON.

Offerings of No. 2 are being made at the posted price of 8.25 cents. In view of recent crude runs and lack of sales, light-fuel inventory in the Gulf Coast is rapidly losing its improved position over last year.

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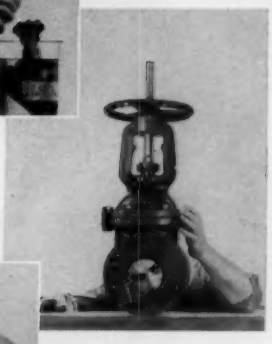
PRESSURE-SEAL VALVES

. . . and here's how he gets it



When the Walworth Customer selects valves for special needs in fluid flow control, he insists on knowing that each type will do its job for a long time, with minimum maintenance. In Walworth Bronze Valves, for example, he finds generous wall thickness, and extra-large stems with extra-deep threads.

In Iron Body Gate Valves, the Walworth Customer checks fully open valves for the free flow of fluids. He finds streamlined ports in the Walworth Cast Steel Gate Valves to fight turbulence and pressure drop.

Tight and fast closures are on his mind when he decides on an LPV, and he finds 100% tight closure in the Walworth Lubricated Plug Valve. It is lubricant-sealed against leakage, opens or closes with a quarter turn, and can be serviced under pressure.

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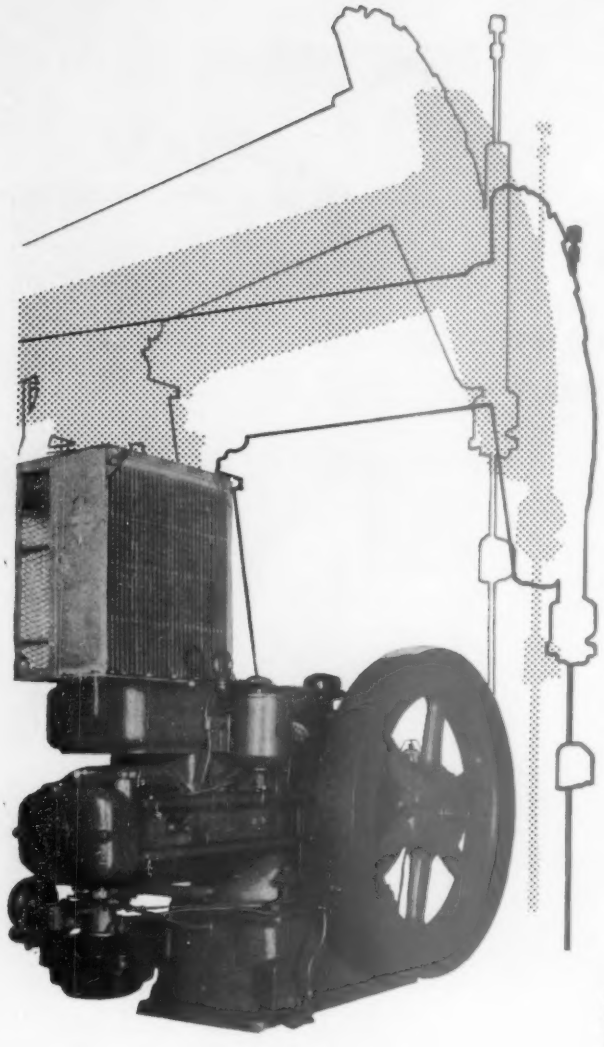

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General Purpose Globe Valve
Fig. 848, Bolted Bonnet
2000 lb WOG
600 lb at 910F
(Sizes ¼" to 1")

High Pressure Globe Valve
Fig. 158, Screwed Bonnet
10,000 lb WOG
(Sizes ¼" to 2")

Fig. 848 features new spiral wound gasket, new solid disk of chrome-cobalt-tungsten alloy, integral Stellite seat, forged steel body and bonnet, exclusive EValloy 13% chromium stainless steel stem, and new swing-style stainless steel gland bolts. Also available in angle design. Fig. 158 features EValized bonnet to resist corrosion and abrasion, and protect stem threads; replaceable screwed-in seat and swivel needle disk of EValloy 13% chromium stainless steel, Impactor* handle, Buna-N "O" rings for leakproof joints. Both valve types are available in choice of screwed or socket welding ends.

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"The capacity of your company to prosper during the next ten years of undoubtedly swift change—to realize the period's profit opportunities—may well depend on your creative marketing and technology. A 5 to 10-year long-range program, that anticipates product and market opportunities and threats before they develop, can provide the advance and imaginative plans and action for competitive leadership in domestic and foreign markets.

"Such planning is providing valuable and confident insight into the future requirements of advertising and its companion marketing functions. When projected in relation to a company's growth program, many a current advertising program and budget is inadequate for the next 5 to 10 years. By this planning process you can optimize advertising's future role in marketing—and establish the major contribution that sound advertising can play in capitalizing on the new markets, new technologies and new management practices of the 1960's."

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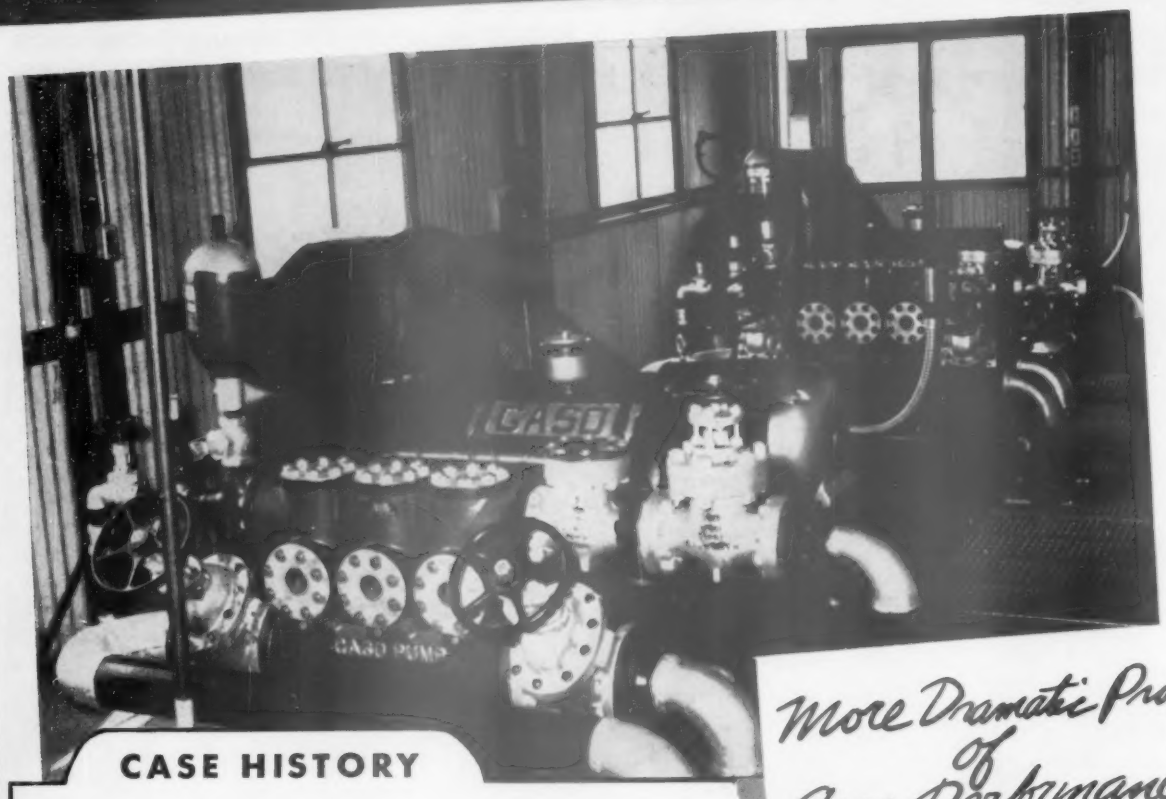
TOTAL MAINTENANCE COST: $73.89



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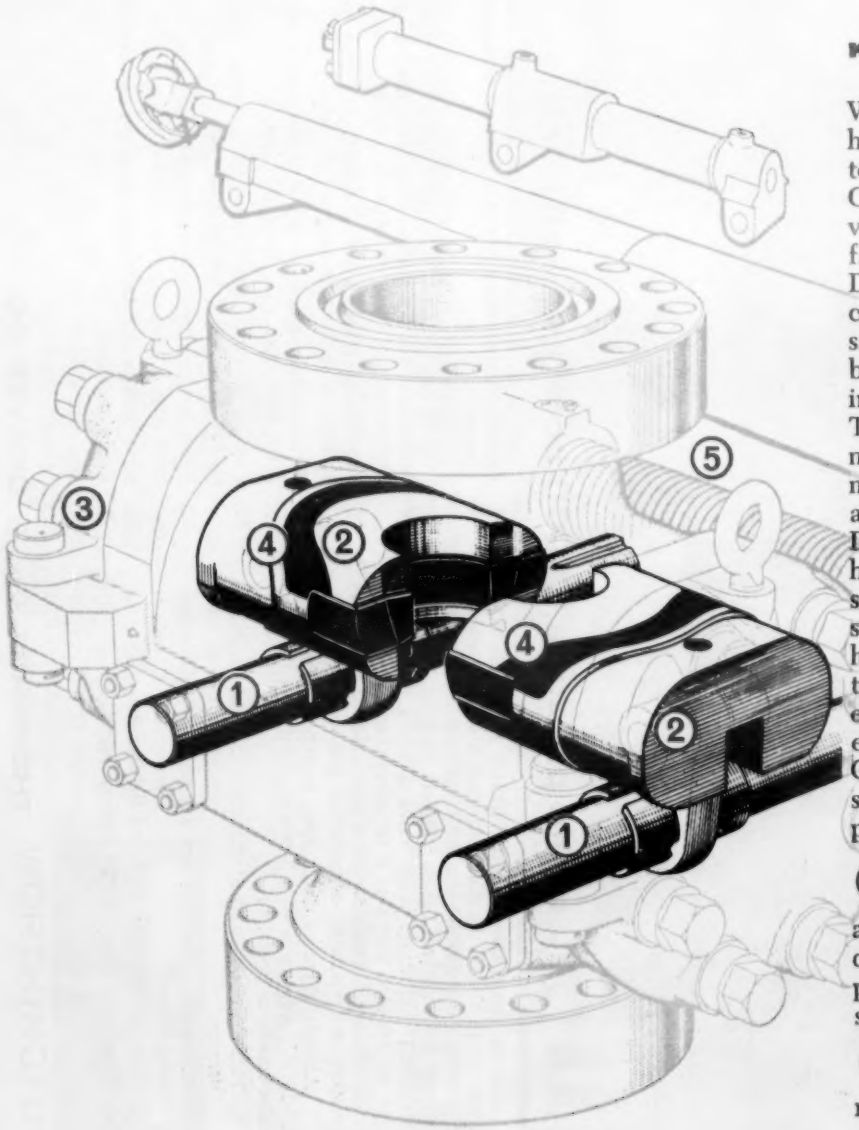

KEEP PROFITS IN PLACE WITH PRESSURE

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Cameron Type "F" Blow Out Preventers are your best bet for a safe, fast, profitable completion.

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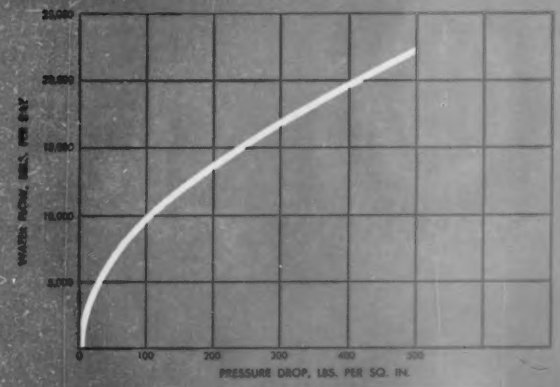
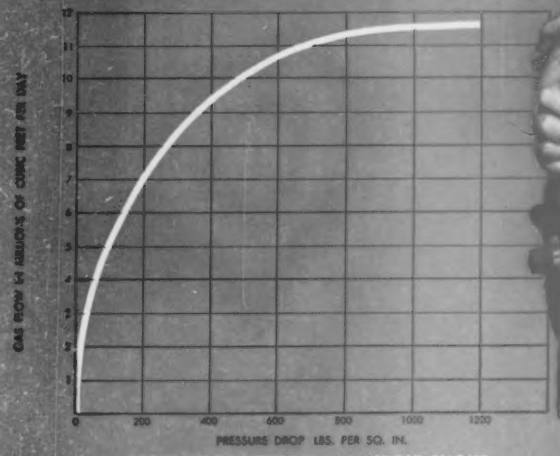


FLOW OF WATER THROUGH UNIBOLT CHOKE WITH 1" SEAT



FLOW OF GAS THROUGH UNIBOLT CHOKE WITH ½" SEAT AT 2000 PSI INLET PRESSURE

if you could produce 10,000 bbls. per well per day . . .

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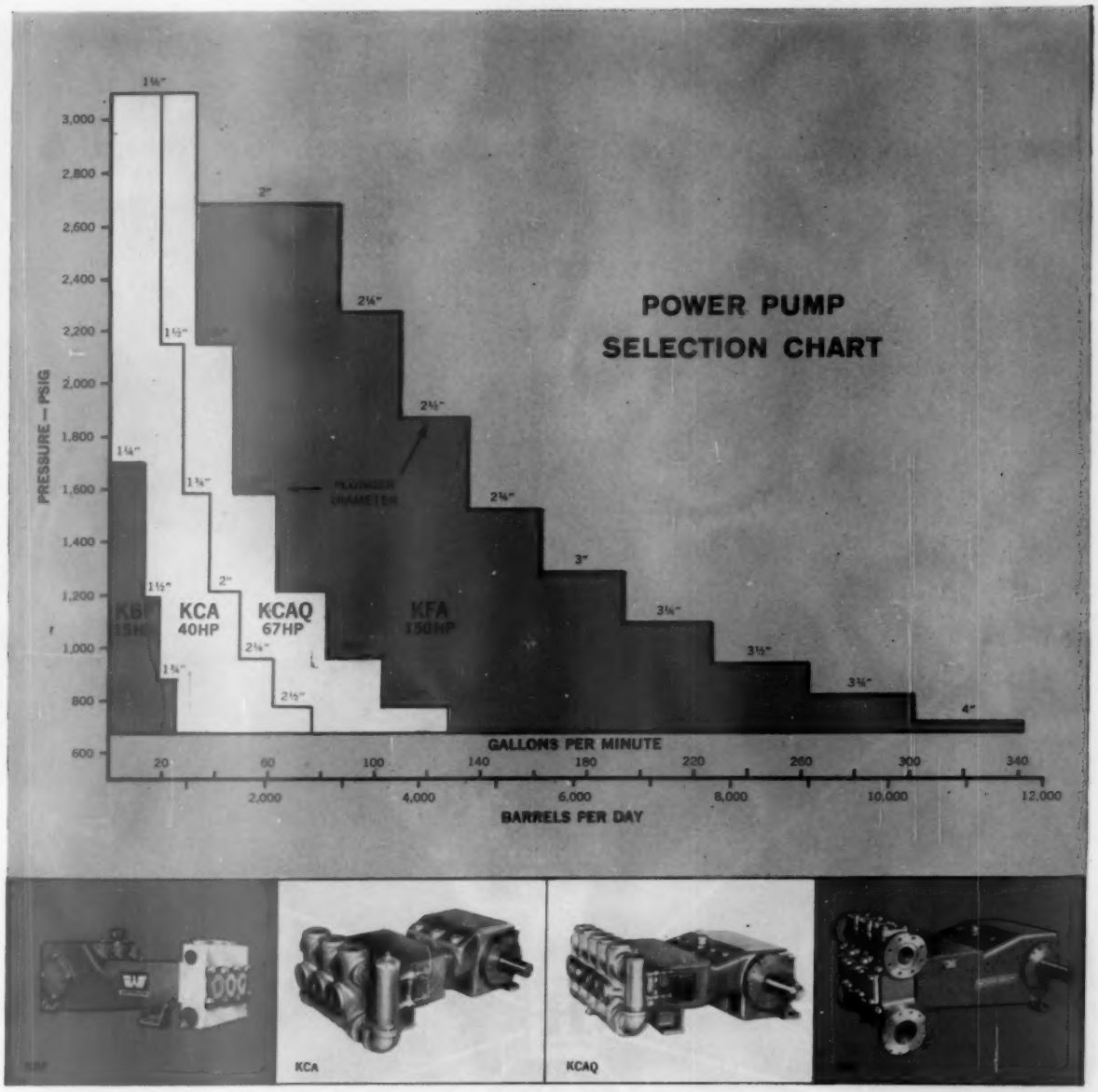
3. Stem packing that needs no tightening.
4. Stem turns freely under high pressures.
5. Threads on stem not exposed to external or internal damage.
6. Full 2½" pilot for true stem alignment and rigidity.
7. Streamlined flow—no obstruction, no turbulence or impingement of flow, no negative pressure areas.
8. Requires no grease to effect a seal . . . may also be used as micrometer-gauged flow bean.
9. Variable choke speeds up initial clean-up or running initial flow tests . . . saves rig time.
10. Can be converted to "Pressurematic Safety Valve" by simply changing bonnet assemblies.
11. Valve can be completely overhauled without removal from tree.
12. Stem seat sealed by metal gasket; power threads assure alignment.

THORNHILL CRAVER CO.
P. O. BOX 1184 HOUSTON, TEXAS



NEW PUMPS EXTEND RATINGS

...to make Worthington your lowest cost high-pressure pump

This is the first public announcement of two new Worthington high pressure, reciprocating pumps. With nominal ratings of 15 and 150 hp, they complement existing pump lines rated at 40 and 67 hp. All are horizontal designs which save you up to 53% on initial cost.

These four pumps—each available in several interchangeable plunger sizes—allow you to buy the most economical amount of pump for your particular application. Should you require pumps of more than one rating, you save money on spares because many parts are interchangeable in the Worthington line.

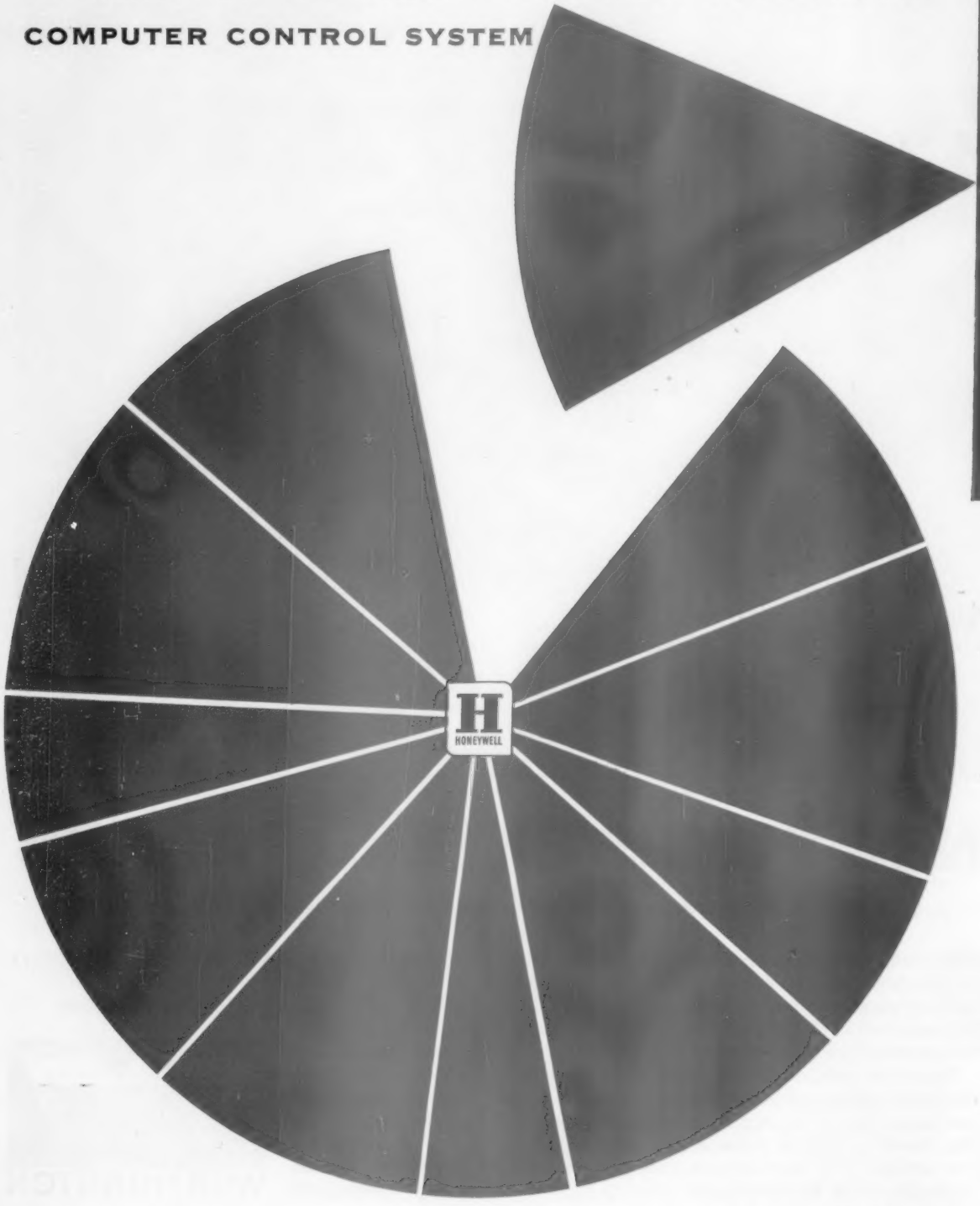
More and more oil producers are choosing Worthington for waterflood applications. A Worthington representative would be glad to explain how this expanded line can save you money on many types of installations.

Get in touch with your nearest Worthington district office. Or write Worthington Corporation, Section 32-8A, Oil City, Pa.

WORTHINGTON

NEW HONEYWELL 290 INDUSTRIAL DIGITAL COMPUTER

. . . HEART OF THE FIRST COMPLETELY INTEGRATED COMPUTER CONTROL SYSTEM



Single-Source Responsibility. Now you can get the first truly complete computer control package produced by a single manufacturer. The new, all-solid-state Honeywell 290 Industrial Digital Computer rounds out Honeywell's broad line of instrumentation, and enables you to specify an all-Honeywell process control system. That means you're protected by single-source responsibility . . . from primary elements to final controls, from initial concept through maintenance.

High Speed plus Reliability. This new computer is the most powerful in its field. Typical operation rates: 8,000 additions, 1,250 multiplications, or 400 square root extractions per second. This high-speed computing of currently pertinent data gives you precise process control. Simplified programming adapts the computer easily to process changes. All-solid-state design and extensive system self-checks are engineered into every circuit and every unit of the computer.

Application Experience plus Computer Know-How. With the addition of the Honeywell 290 computer to the world's most extensive line of measuring and control equipment, Honeywell systems engineers now have the tools to implement all applications including those requiring computer control.

Take advantage of Honeywell's 75 years of experience in industrial process control. Get the advantage of having your entire system under Honeywell's overall responsibility.

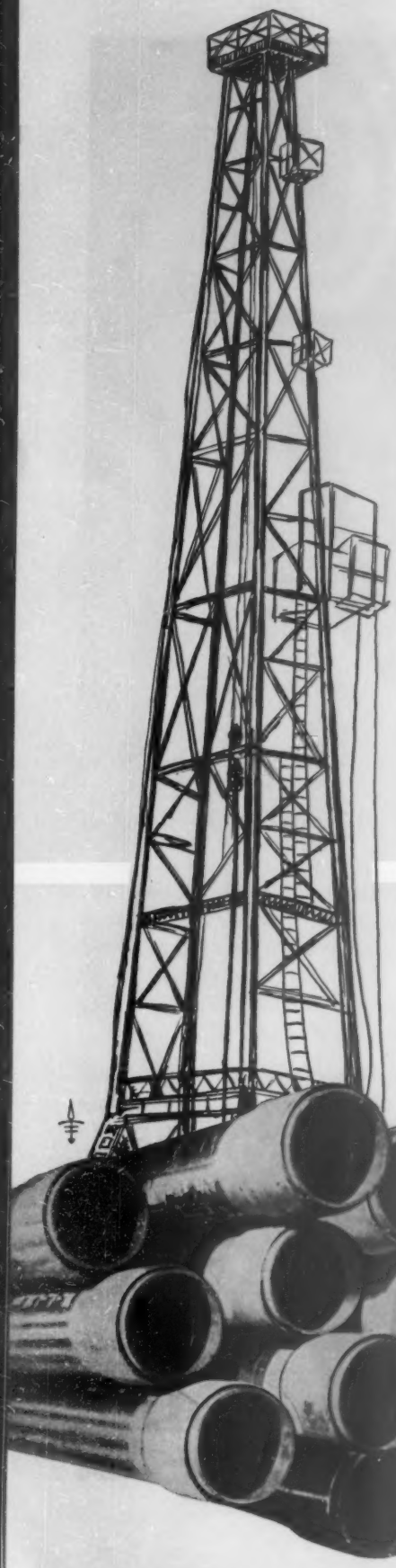
MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa. In Canada, Honeywell Controls, Ltd., Toronto 17, Ontario.

75th YEAR — PIONEERING THE FUTURE

Honeywell

First in Control

SINCE 1885



Our program for the petroleum industry comprises the following products:

DRILL PIPE in all sizes according to API Std. 5 A from 2 3/8" O. D. up to 6 5/8" O. D. with screwed-on, shrunk-on and welded-on Tool Joints

CASING in all sizes according to API Std. 5 A from 4 1/2" O. D. up to 20" O. D. with short and long threads and couplings

TUBING in all sizes according to API Std. 5 A from 1,05" O. D. up to 4 1/2" O. D. non-upset and external-upset

LINE PIPE in all sizes according to API Std. 5 L and 5 LX from 1/8" Nom. Size up to 36" O. D. seamless and welded

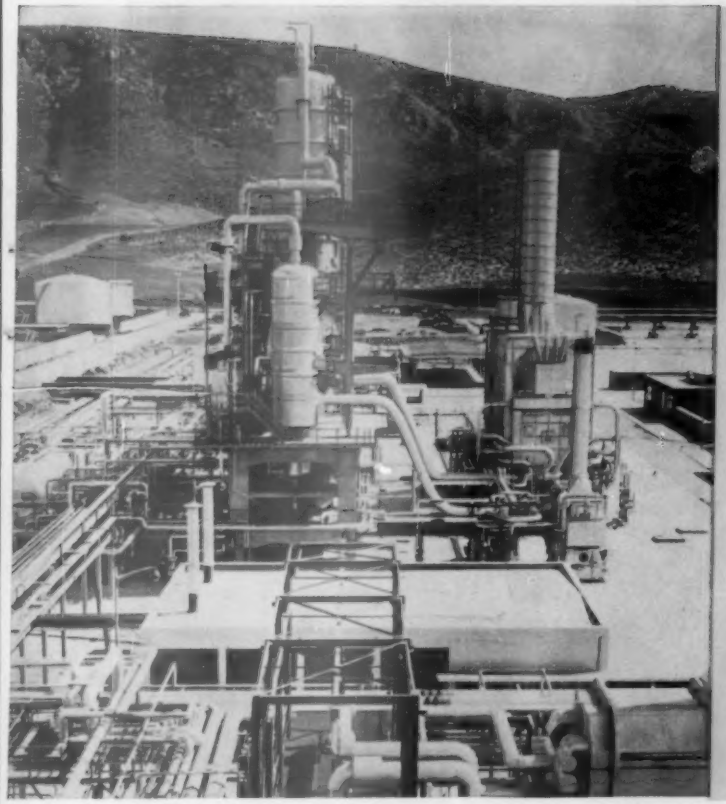
PIPE FOR DISTILLATION PLANTS, CRACKING PLANTS ETC. in all sizes for all stresses

STEELS: all normal API grades as well as special steels for maximum stresses

SPECIALTY

CASING and TUBING with extremely high joint strength
OMEGA-JOINTS and EXTREME LINE JOINTS

Demand our special catalogues



Varying according to the specific requirements we supply the following products made of standard and special steels as well as of clad plates:

Containers and apparatus, such as:
coke towers · vacuum towers
fractionating columns · stabilizers · reactors
evaporators · heat exchangers · coolers
high pressure vessels
as strip-wound pressure vessels
or solid vessels
transport vessels
storage vessels for liquids and gases
spherical caps and segments, hot-pressed
for spherical containers
heads, hot-pressed · flanged and flad heads
spherically dished heads, ellipsoidal heads
shells, bent and welded
tubular coils and tubular systems
tube bends and specials
tubes for distillation, refinery and cracking plant etc.
· flanges · fittings with API-threads
wide flat steel · plates, sections and bars
made of unalloyed and low-alloy materials
plates, medium plates and sheets, sections and
bars as well as electrodes
made of our SICROMAL and RHEINROHR
special steels
clad plates

PHOENIX-RHEINROHR AG
VEREINIGTE HÜTTEN- UND RÖHRENWERKE DÜSSELDORF
GERMANY

Phoenix Rheinrohr Corporation,
20 East 46 th Street, New York N. Y. 17

How much CF&I Casing and Tubing *should go into this new well?*

Someone once asked Abraham Lincoln, "how long should a man's legs be"? The president replied, "long enough to reach the ground". The same is true of CF&I Seamless Casing and Tubing. You need enough to protect your investment and bring oil to the surface.

Why should you insist on CF&I Casing and Tubing? Because it is made from top grade steel . . . subjected to strict quality control throughout every stage of production . . . and meticulously manufactured in one of the most modern mills in the industry.

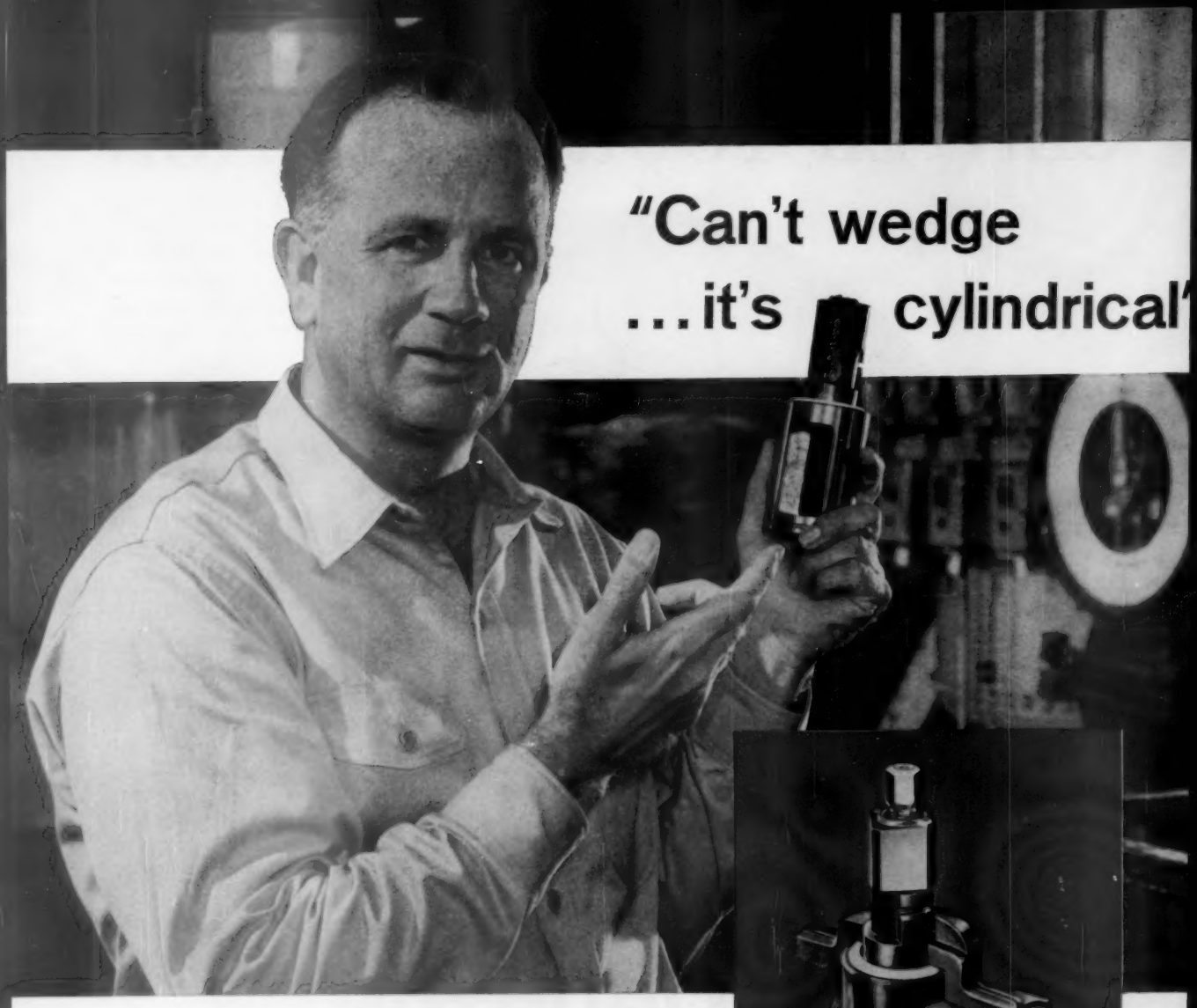
CF&I's Seamless Casing and Tubing mill is only hours away from the heart of the oil country. This assures rapid delivery — either directly from our Pueblo, Colorado mill or through our network of strategically located distributors.

All CF&I Casing and Tubing exceeds API Specifications. It's available in sizes 2⅜" to 9⅝" O.D. For complete information or technical service, contact a nearby CF&I sales office.

7610

CF&I STEEL **SEAMLESS** *casing and tubing* API

THE COLORADO FUEL AND IRON CORPORATION • DENVER, COLORADO



acf® Lubricated Plug Valves

There's no taper to cause sticking or wedging in an ACF valve. And the plug can't be unseated.

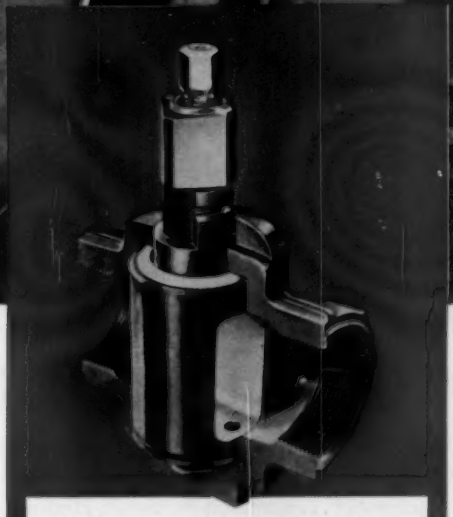
The baseplate spring and line pressure hold the plug tight against the Teflon head seat gasket. All friction surfaces are constantly lubricated for easy quarter-turn operation and protection against corrosion.

Next time — and every time — specify ACF! *Available from leading suppliers everywhere.*

WRITE FOR CATALOG 400

W-K-M

DIVISION OF acf INDUSTRIES
INCORPORATED
P. O. BOX 2117, HOUSTON, TEXAS



ACF semi-steel lubricated Plug Valves are available in rectangular, round, diamond, and V ports; venturi, multiport and steam-jacketed models.

Materials: steel, semi-steel, Ni-resist, carbon steel, bronze, aluminum.

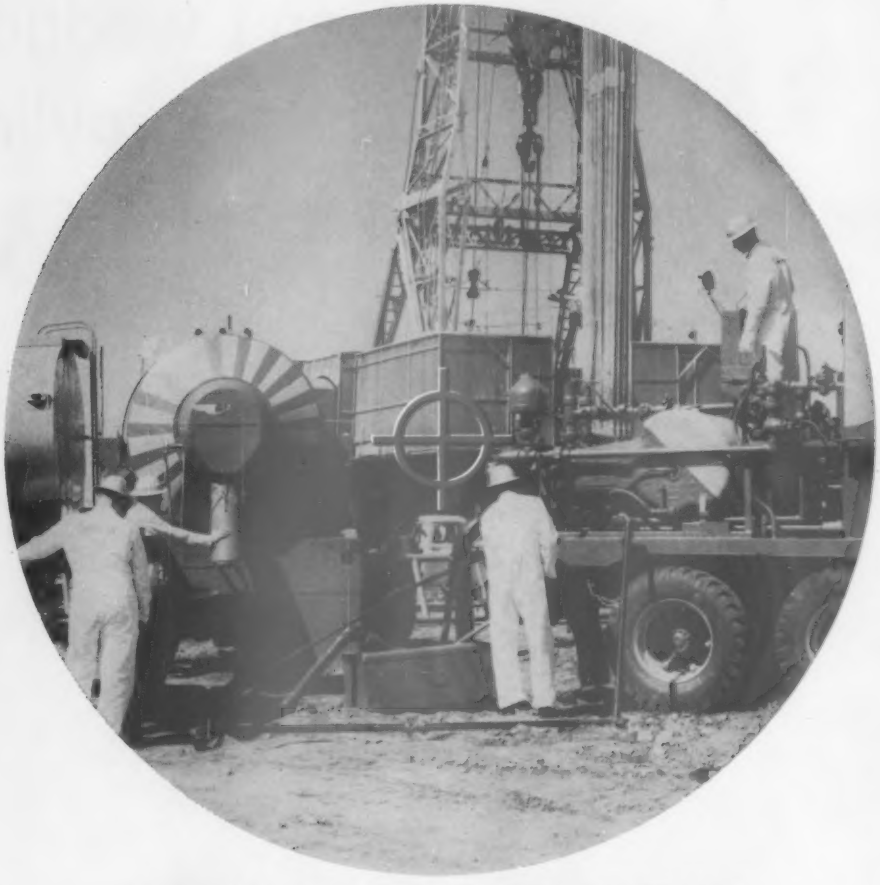
Sizes: ½" through 30".

Working Pressures: 125 through 800 pounds.

PRODUCT OF W-K-M's
Creative Engineering

5910-R

CENTER YOUR ATTENTION

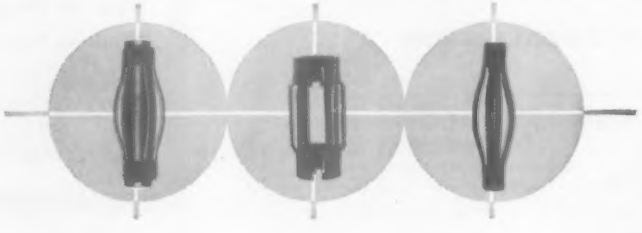


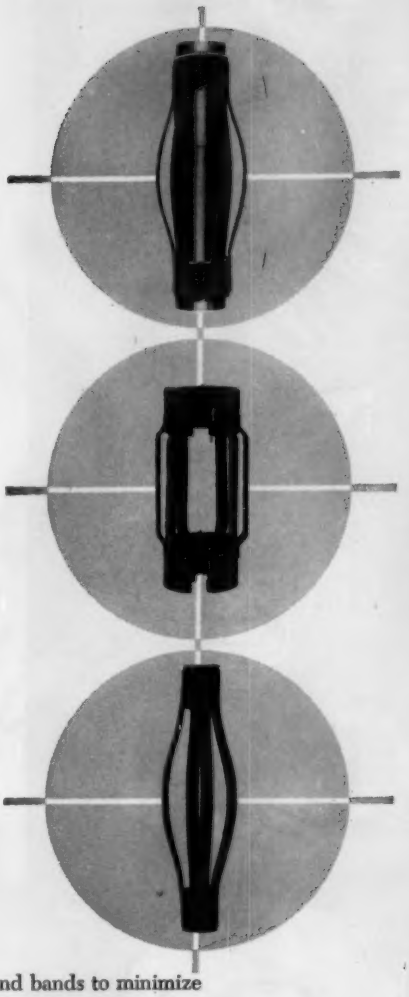
HALLIBURTON
THE FULL LINE OF CENTRALIZERS

The SUCCESS of a good cementing job depends on many things – experienced men . . . well designed equipment . . . attention to detail. High on this list of importance is the need for keeping the casing centered in the hole while cementing to help provide a better more thorough bond of cement on all sides of the casing. This full circle of cement contributes to the protection of the surrounding formation as well as the casing.

Helping to keep the casing centered is the task assigned to Halliburton Centralizers. They are designed to function in all wells – straight or crooked – deep or shallow. Experience has convinced thousands of operators they can *plan* on Halliburton Centralizers' ability to do the job and help provide better cement distribution.

Unique design, quality workmanship and rigid inspection methods make the Halliburton line of Centralizers tops in the field . . . just like the many other products and services offered by your nearby Halliburton Representative. Contact him before your next cementing job.





FOR REGULAR CASING STRINGS

... the S-3 Centralizers are available in a complete range of standard casing sizes from 4½" through 24" O.D.... with special sizes furnished on request. The S-3 is equipped with 28" long heat-treated steel springs designed for maximum casing centering with a minimum number of centralizers required.

FOR SLIM HOLE STRINGS

... the Slim Hole Centralizers are of positive type preformed steel springs and tailored for pipe sizes ranging from 2⅜" through 9⅝" O.D. Overall length is 18" with 1" high-strength springs designed for specific slim hole sizes or for liners run inside casing.

FOR TUBING STRINGS

... the Tubing Centralizer standard sizes range from 2⅜" through 4" E.U.E.... with other sizes available on special order. Tubing Centralizers are of the same design and overall length of the popular Model S-3 type Centralizer... steel springs are heat-treated to give maximum centering force for helping to protect tubing against wear when run in and out of casing... centering of tubing in open hole also gives better placement of cement around the string.

compare these advanced features...

- **Ample Clearance** between casing or tubing and centralizer end bands to minimize drag when rotating pipe.
- **Special Heat Treated Steel Springs** help prevent loss of bowed height to retain maximum centering force for pipe after trip to bottom.
- **Hinged Type** saves rig time—no welding required when hinged over collars.
- **Lap Welded Construction** of springs to end bands minimizes spring breakage often occurring from butt-welding.
- **Good Annular Circulation** since adequate spacing of springs minimizes obstruction to flow of fluid.

EZ LOK LIMIT CLAMP

... new method of installing auxiliary equipment on casing or tubing without welding. Hinged for easy installation.

***NEW*... FOR TUBINGLESS COMPLETIONS**

... the new wrap-around Halliburton Tubing Spacer, easily applied with metal banding, is molded of hard rubber with six positive type ribs. Tapered design helps prevent coupling interference when running tubing... ⅝" minimum stand-off provides less fluid restriction.

This full line of Centralizers is typical of the Halliburton idea of *complete* service to the industry. Call your Halliburton Representative for the full story.

275 SERVICE CENTERS—JUST MINUTES AWAY FROM YOUR WELL

HALLIBURTON

CEMENTING SERVICES

HALLIBURTON COMPANY • DUNCAN, OKLAHOMA

92%

OF THE WORLD'S
OIL COMPANIES USE
MAGCOBAR
DRILLING MUD
PRODUCTS

All around the world it has been conclusively demonstrated that Magcobar's better-engineered drilling mud products reduce unnecessarily high drilling costs. Wherever you are, a planned Magcobar mud program can mean faster drilling rate with less down time. And at the same time, a cleaner hole, better cuttings, better logging, and better cores can result.

The benefits of a good mud program, a *planned* Magcobar mud program, are reflected in total drilling cost. These benefits can extend even to better and more production without the use of stimulants.

On your next well, reduce hole time, speed up drilling, stabilize the hole, and reduce wear and tear on drilling equipment. You'll be in good company, too, right along with the 92 per cent of the world's oil companies who use Magcobar now. And you'll be helping yourself with the better-engineered mud products of Magcobar.

Magcobar®
Complete
DRILLING MUD SERVICE

DRESSER
INDUSTRIES, INC.
OIL • GAS • CHEMICAL
ELECTRONIC • INDUSTRIAL

MAGNET COVE
BARIUM CORPORATION
Houston

Well Done With
Magcobar Technology

Hydro Hook
W W
Pick the finest
ALL FROM ONE MANUFACTURER
BAASH-ROSS
BAASH ROSS
TYPE
W W
CONTACT YOUR
BAASH-ROSS REPRESENTATIVE
BAASH ROSS DIV
OUR 41ST YEAR OF PROGRESS
Baash-Ross and Web Wilson Tools are sold only thru supply stores
JOY
BAASH-ROSS
DIVISION OF JOY MANUFACTURING CO.
General Offices: Houston, Texas

REPUBLIC IS READY...

READY WITH

X-TRU-COAT!

For more jobs, and more big jobs . . .

NEW SIZES THROUGH 8" NOMINAL

With the introduction of new sizes through 8" nominal, the outlook for Republic X-TRU-COAT is brighter than the color of its yellow coating. Even so, it will be tough to beat its past success. Already—*in less than three years*—utilities have capitalized on 28 million feet of this polyethylene-coated line pipe.

The new 6" and 8" diameters for bigger piping jobs can solve a greater number of gas and oil distribution problems. To make X-TRU-COAT even more useful, you can have it in new light wall diameters (1" through 4" nominal) to take advantage of the economy of light wall pipe.

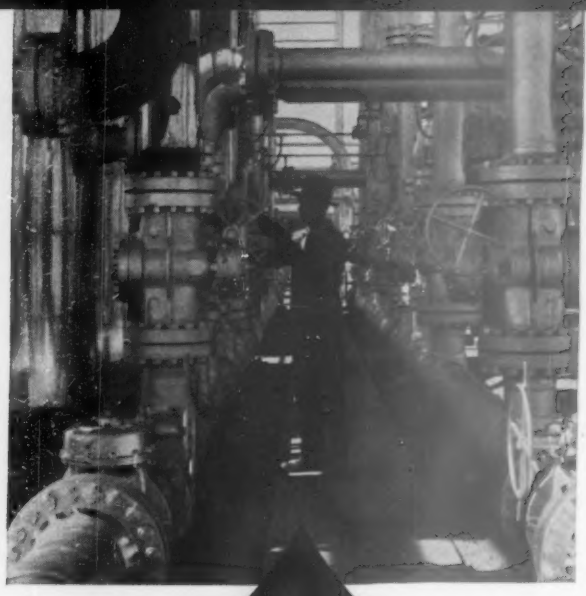
The reason for the acceptance of X-TRU-COAT is its totally effective, highly uniform corrosion-protection. The high density polyethylene coating is applied at the mill with the same production care and quality control standards as are applied to the production of the pipe itself. The coating is not applied under varying field conditions or as a production afterthought. The corrosion-protection of X-TRU-COAT has proved far more dependable than any field or other mill applied coating.

You can get all the facts on X-TRU-COAT by mailing the coupon on the following page.

Republic X-TRU-COAT is produced under the Dekoron® Process.

REPUBLIC STEEL

ELECTRIC WELD • FUSION WELD • CONTINUOUS BUTT WELD • LIGHT WALL • X-TRU-COAT • PLASTIC PIPE



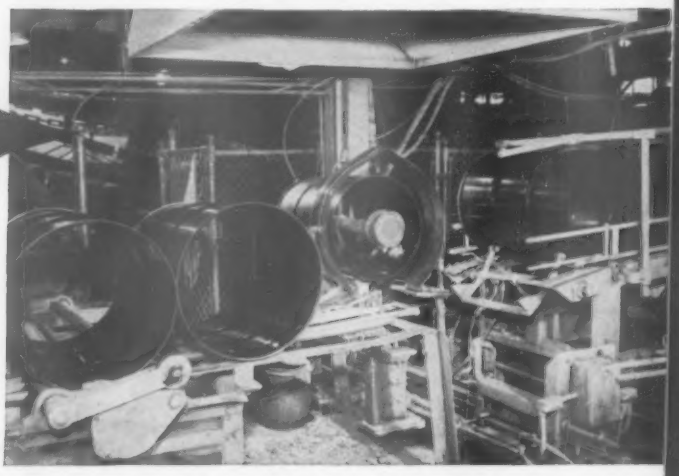
STUDS THAT BACK OFF FAST

Alloy steel studs made by Republic are characterized by accurate, full-formed threads. Usually furnished in AISI 4120 Chrome-Moly Steel, heat treated to ASTM A193, designation B-7, or in designations B-14 and B-15 for higher temperatures. Exceptional high strength eliminates danger of creep, stretch, or fatigue failure. Send coupon for booklet listing types, sizes, and complete specifications.

ELECTROSTATICALLY LACQUERED DRUMS

Lacquer-lined drums available from Republic assure peak protection for your product. In Republic's ELECTRO-LAC Process, a fine lacquer mist is dispersed from a high speed distribution head. This mist is uniformly attracted (as a result of an electrostatic field produced in the drum) over the entire interior. Thin spots in the coating are eliminated. Ask your Republic Container salesman for details or mail the coupon.

REPUBLIC IS READY... READY WITH



TUBING WITH SNAP-TIGHT COUPLINGS

Lightweight Republic ELECTRUNITE® Grooved-End Tubing has the strength—the strength of steel—to withstand dents, slashes, and ruptures in temporary field installations. Victaulic Couplings speed joining and disassembly. ELECTRUNITE is produced from highest quality carbon steel, grooved at the mill, carefully inspected and controlled through every step of manufacture. Send for information.

REPUBLIC STEEL CORPORATION
DEPT. OG-9301
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send more information on:

☐ X-TRU-COAT
☐ Alloy Studs and Hex Nuts
☐ Grooved-End Steel Tubing
☐ Electrostatically-Lined Drums

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

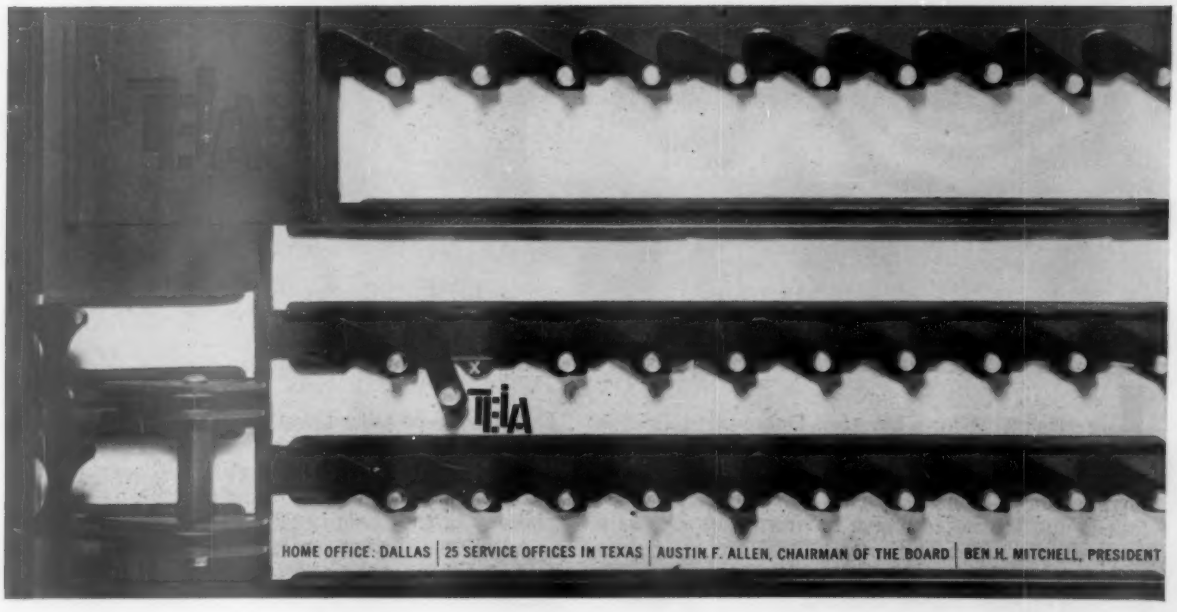
Again last year, over a fourth of all the workmen's compensation insurance bought by Texas employers was bought from TEIA ... far more than from any other company. What better proof of the preference for TEIA's protection.

And what better reason for you to call the nearest TEIA man.

TEXAS EMPLOYERS' INSURANCE ASSOCIATION

First choice of Texas Industry for over 45 years

PREFERRED



Investing $171 for a barrel of Duomeen® CD-50 is obviously less costly than shelling out $1700 for a load of new pipe. Yet every year oil producers are paying out millions of dollars to replace pipe that failed, due to the corrosive environments in water systems. By using Duomeen CD-50, a combination corrosion inhibitor and bactericide, much of this needless expense can be avoided.

Extensive field tests have established sulfate-reducing bacteria to be one of the more important factors in causing corrosion. Thorough investigations have also proven the effectiveness of Duomeen CD-50 in preventing the harmful effects of these bacteria.

Additional savings result with the use of Duomeen CD-50 because many costly remedial measures are eliminated. Savings are effected by the prevention of

Save $1700

bacteria and bacterial by-product plugging, less down-time, and lower power costs to maintain injection pressures.

For complete detailed information on Armour's bactericides—corrosion inhibitors and other chemicals for oil production, write for the booklet, "Armour Organics for Increased Oil Production." Samples of Duomeen CD-50 and other Armour oil production chemicals for your own testing are also available.

Armour Industrial Chemical Company
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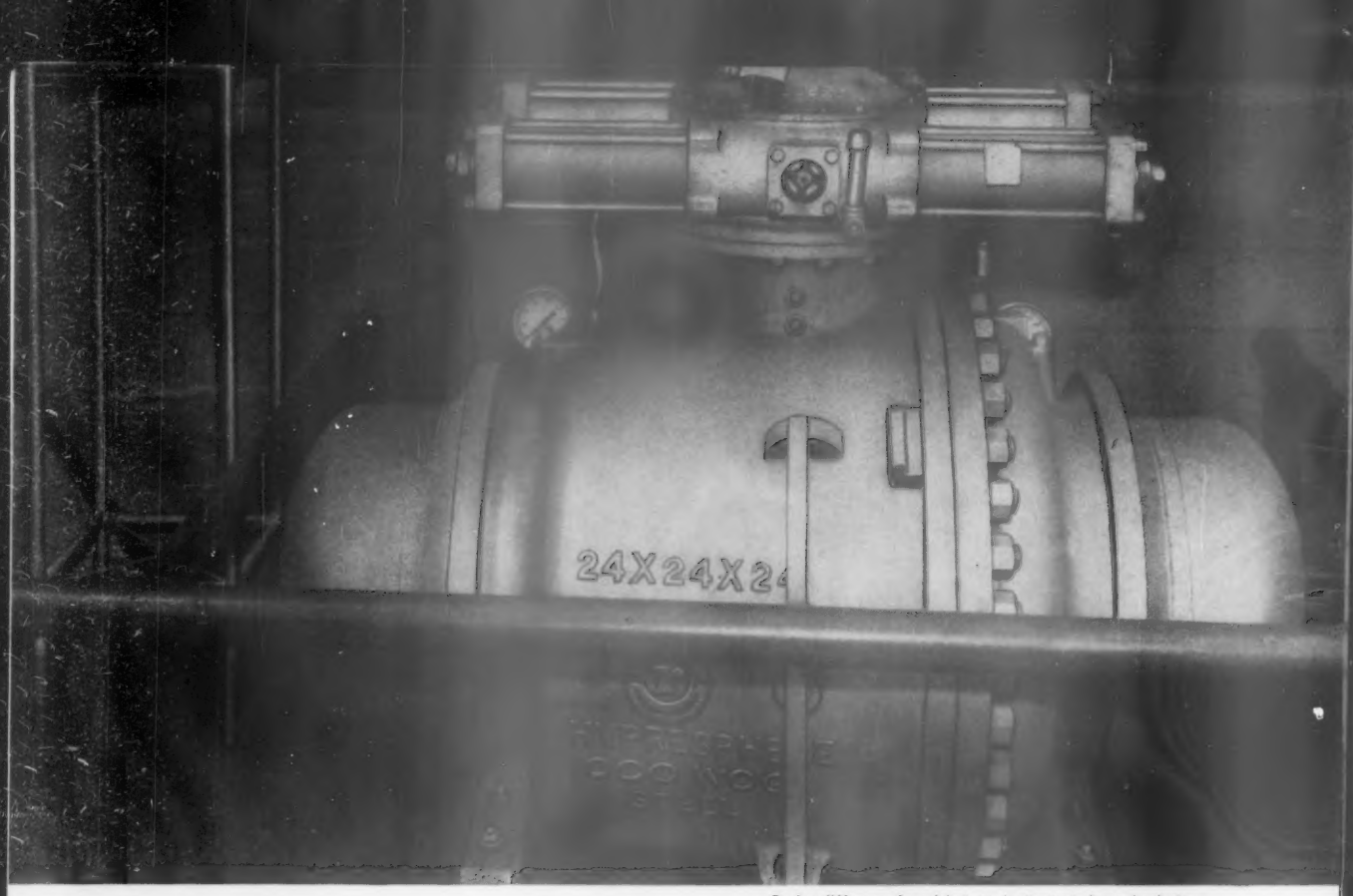
110 North Wacker Drive • Chicago 6, Illinois



Rockwell Hypresphere lubricated spherical plug valve being tested through 10,000 full open-close operating cycles at 900 lb psi.

THE PIPELINE VALVE THAT WOULDN'T WEAR OUT

The Rockwell Hypresphere lubricated spherical plug valve shown above has been test operated from full open to full closed 10,000 times. Line pressure on the test fluid was built up to 900 psi for *each* full open-close test cycle. At test's end, there was no apparent wear and the valve held bottle tight shut-off!

In the Hypresphere (like all other Rockwell-Nordstrom *lubricated* plug valves), pressurized lubricant insures positive shut-off and prevents metal-to-metal wear. *To prove that this is fact and not theory, make your own inquiries on how many pipeline lubricated plug valves have ever had to be overhauled in the field or replaced.* Additional advantages of the Hypresphere: full round opening, exceptionally compact, and closure 2 to 5 times faster than non-lubricated valves. For complete details on the *complete* line of lubricated plug and spherical plug valves for pipeline services, write: Rockwell Manufacturing Company, Dept. 92-H, Pittsburgh 8, Pa. Canadian Valve Licensee: Peacock Brothers Limited or Rockwell International, S.A., Geneva, Switzerland.

Lubrication Makes the Difference

ROCKWELL HYPRESPHERE VALVES

another fine product by

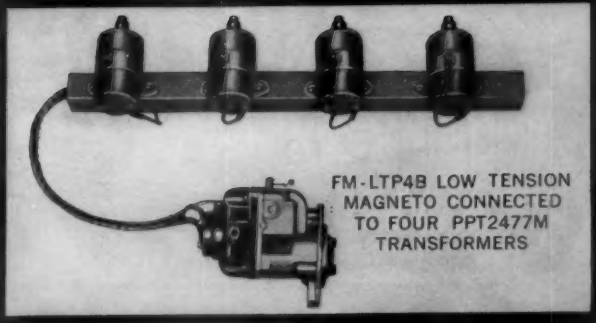
ROCKWELL

This Rockwell Hypresphere valve, ready for buried installation, will save money at the outset by eliminating need for costly vaults.

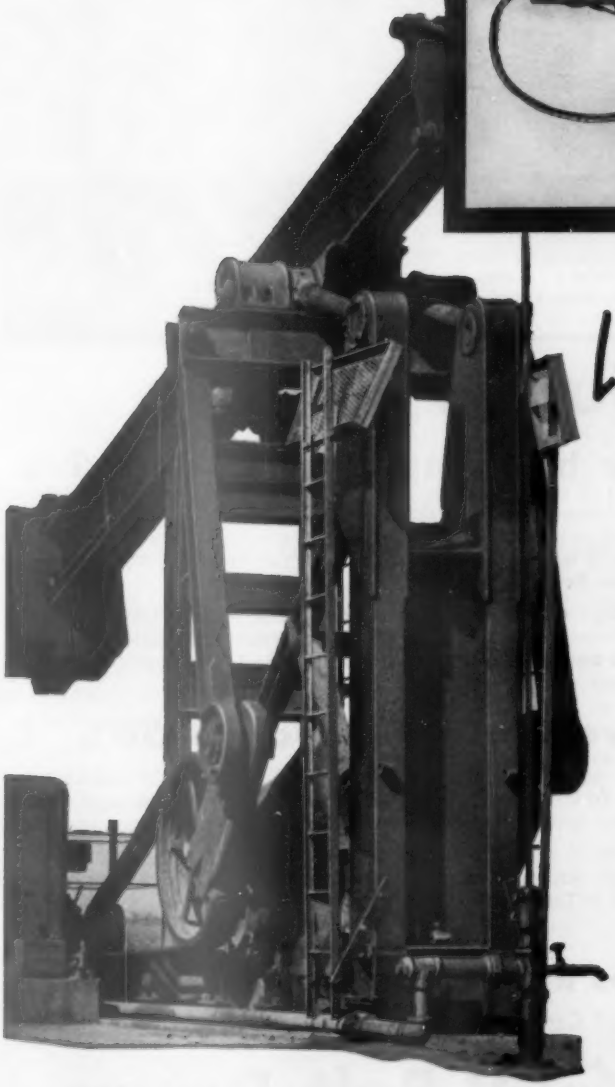
We'll help you

PUMP GREATER PROFITS

(by cutting engine maintenance costs)



FM-LTP4B LOW TENSION MAGNETO CONNECTED TO FOUR PPT2477M TRANSFORMERS



Fairbanks, Morse

Low tension ignition

- **Reduces maintenance and operating costs.**
- **Increases spark plug life**
- **Easy, Quick installation**
- **Eliminates expensive stoppage in multiple cylinder units**

Now you can effectively reduce pumping and drilling costs by equipping your rig with the Fairbanks-Morse Low Tension Ignition System. Designed for spark-fired engines, this new ignition development increases engine life, helps provide trouble-free performance.

It gives a positive, intense spark **without** ozone and high-corona discharges, eliminating "green corrosion," providing better bearing lubrication.

The F-M magnetos and transformers are easily installed in the field on one, two, four or six cylinder engines. Once installed, you can rely upon Fairbanks-Morse built-in quality for dependable, trouble-free operations 'round the clock.

For information as to how Fairbanks-Morse Low Tension Ignition Systems can give you stepped-up pump and drilling performance, write to: Fairbanks, Morse & Co., Beloit, Wisconsin

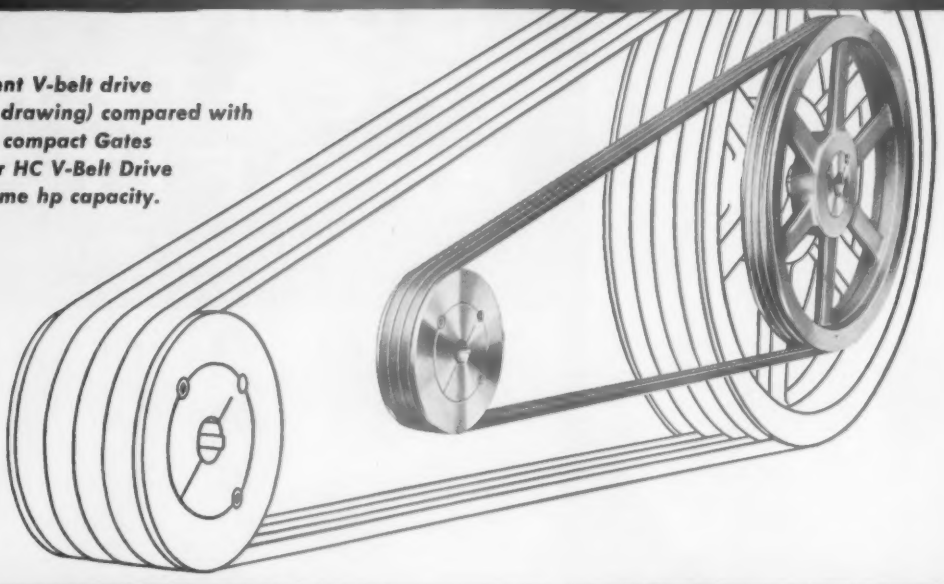
Fairbanks, Morse

MAGNETO AND ENGINE ACCESSORIES DIVISION

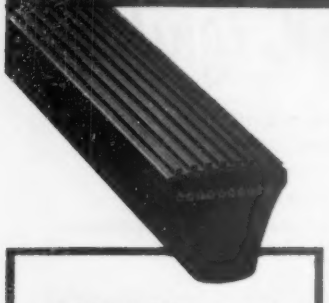
A MAJOR INDUSTRIAL COMPONENT OF **FAIRBANKS WHITNEY CORPORATION**

Designing NEW DRIVES?

Present V-belt drive (line drawing) compared with new, compact Gates Super HC V-Belt Drive of same hp capacity.



COMPARE: Left, typical drive with present V-belts. Right—drive of same hp capacity with Gates new Super HC V-Belts . . . uses fewer belts, smaller sheaves and shorter center distance.



For NEW drives on mud pumps Gates compact new Super HC V-Belt with the patented ribbed top cuts space required up to 50% and cost as much as 20%.

Gates

World's Largest Maker of V-Belts

Save up to 20%

with new high capacity V-belt drive

When you change the whole drive—on mud pump, pumping unit, or any other piece of petroleum equipment—remember: The cost of a Gates Super HC V-Belt is as much as 20% less than the cost of present V-belt drives of the same horsepower capacity.

A development of Specialized Research in the world's largest V-belt laboratories at Gates, the new Super HC V-Belt makes possible the most compact, lightest-weight, lowest-cost multiple V-belt drive you can put on any pump!

Cuts drive space as much as 50%

With Gates new Super HC V-Belt, sheave diameters and widths can be reduced 30% to 50%, center distances 20% and more. Bearing load is lightened and total space occupied by the drive may be cut as much as 50%.

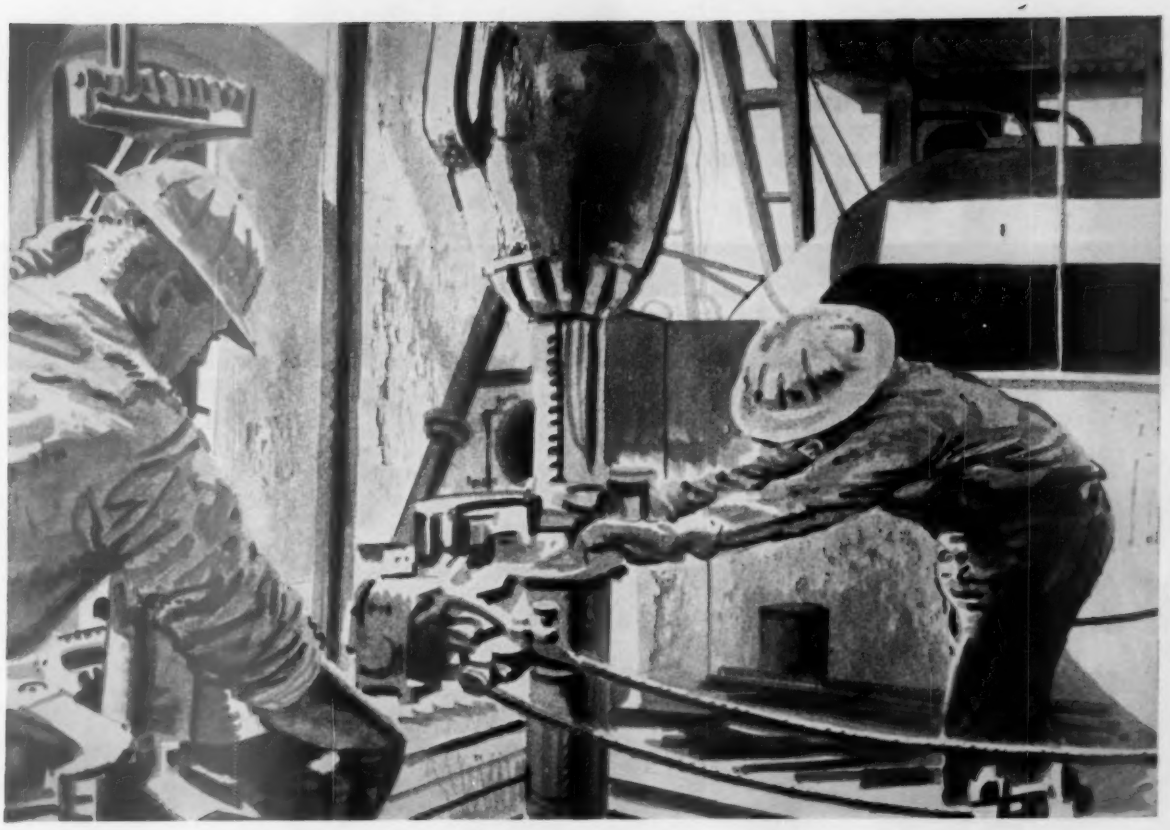
"The Modern Way to Design Multiple V-Belt Drives" is an informative handbook on the Super HC Drive, available from your nearby Gates Distributor listed in the Yellow Pages of your phone book.

The Gates Rubber Company, Denver, Colorado

Gates Rubber of Canada Ltd., Brantford, Ont.

TPA 439B

Gates Super HC V-Belt Drives



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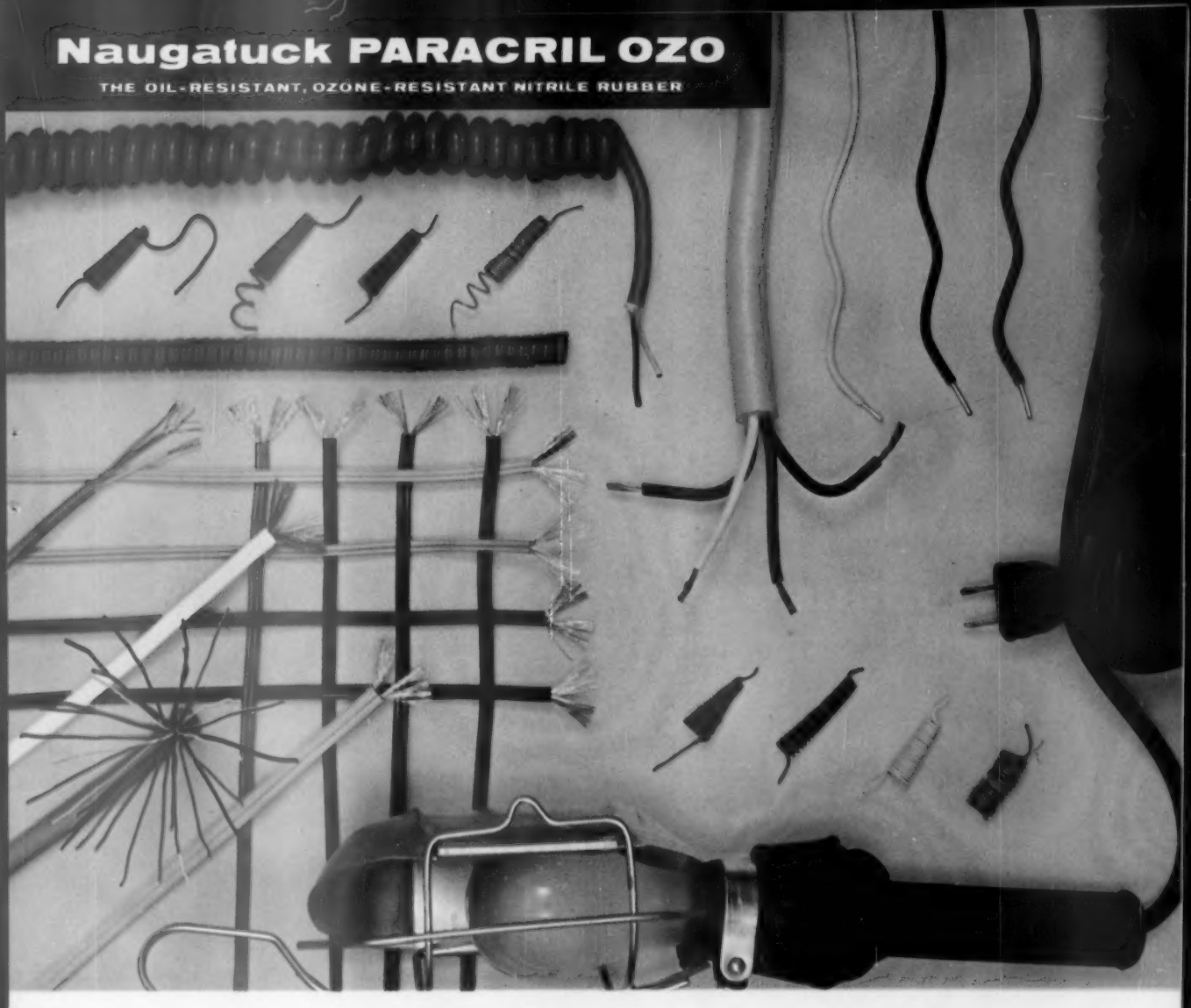

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They Say—

Praise for booklet

Dear Sir:

I have looked over your booklet ("Why Is Gasoline Such a Bargain?", OGJ, Aug. 1, p. 138) carefully and certainly congratulate those responsible for both the art work and the editorial material.

I hope it gets widespread distribution.

Millard Neptune
Senior Vice President
Texas Eastern Transmission Corp.

Dear Sir:

The booklet is very well done . . .

M. H. Robineau
President
Frontier Refining Co.

Dear Sir:

Our people agree that this is an exceptionally easy-to-read story. In fact, most of us who picked it up did not put it down again until we finished the last page.

The Oil and Gas Journal will be interested in knowing that we plan to distribute this pamphlet to employes, Chevron dealers, wholesalers, civic and service clubs, and to influential friends in our marketing area.

C. B. Bellinger
Public-Relations Supervisor
Standard Oil Co. of Texas
El Paso

Shell's quarter interest

Dear Sir:

Since we have 24.4% participation in Block 9 operation you describe in article on page 50, August 8 issue ("Atlantic Pumps LPG Into Big Flood"), we regret you left out Shell Oil Co. in last paragraph, page 51.

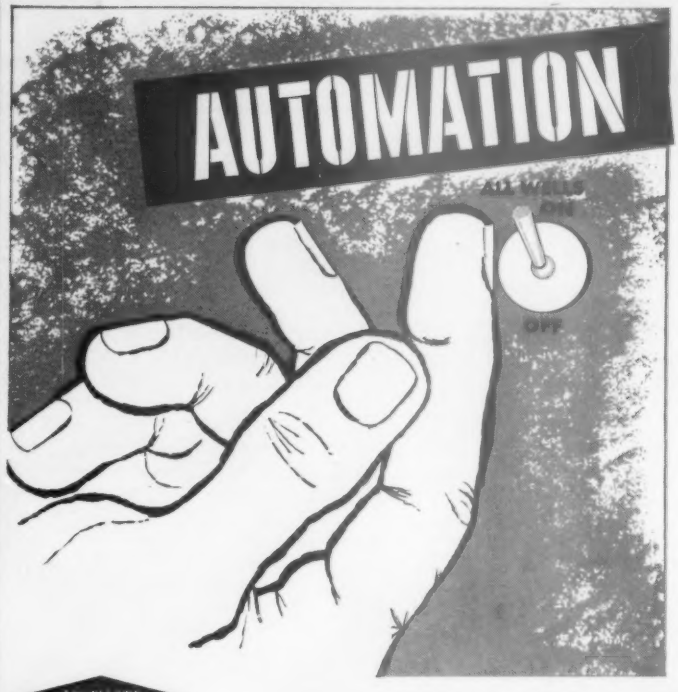
F. E. Davis,
Area Public-Relations representative
Shell Oil Co.
Midland, Tex.

A year late

Dear Sir:

In the Itemized Cost Indexes in the Journal's July 4 issue, page 100, shouldn't the date in the February 1959 column be February 1960?

Incidentally, I enjoy your excellent



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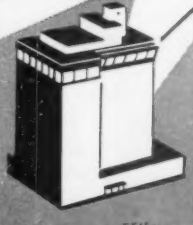

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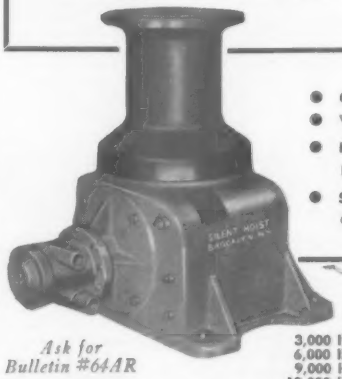

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Journal and find these indexes very useful.

C. W. Shinnamon
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Dallas.

Editor's note: Reader Shinnamon is right. The date should be 1960.

Tipro still for tariff

"There seems to be no doubt that a marketing war between international companies could bankrupt the domestic producing industry in a hurry—unless we have some effective control method to prevent the flooding of this country with foreign oil.

"For the time being at least, we believe that the mandatory imports program will prove sufficient to insulate this market from senseless destruction . . .

"Our concern is not with the price of crude oil abroad as such, but with the impact which price cutting abroad might have upon the U. S. producing industry. Officials responsible for the mandatory program are aware that crude-price stability is absolutely essential to the maintenance of a reserve producing capacity in proper relation to needs in peace or war. The means must be found for making sure that the price of crude oil in the United States is not dictated by conditions abroad.

"At our executive committee meeting, Tipro again reiterated its historic position that some form of equalization tariff or duty is the best means of protecting the domestic industry against this type of price competition from abroad.

"In a period of prolonged oversupply, it may be necessary to arrive at some means of supplementing the present mandatory program with some form of duty, perhaps along the lines of the competitive bidding proposal offered for consideration earlier by independent producers."

John G. Hurd, president of Texas Independent Producers and Royalty Owners Association, in a statement concerning lowered crude price postings in the Middle East.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

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CALENDAR

AUGUST

29-31 Appalachian Gas Measurement Short Course, University of West Virginia, Morgantown, W. Va.

30-Sept. 2 American Association for the Advancement of Science, Alaska Division, eleventh Alaskan science conference, Anchorage.

SEPTEMBER

6-7 Chemical Institute of Canada, organic chemistry division conference, Edmonton.

7-9 American Society of Mechanical Engineers, joint automatic control conference, Massachusetts Institute of Technology, Cambridge, Mass.

7-10 Billings Geological Society, annual field trip, Hebgen Lake-Madison Valley area of southwestern Montana.

8-9 National Research Council, Chemical Institute of Canada, tenth Canadian high polymer forum, Alpine Inn, Montreal.

8-9 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.

8-10 Chemical Institute of Canada, western regional conference, Regina.

8-10 Intermountain Association of Petroleum Geologists and Eastern Nevada Geological Society, field trip, economic geology of east-central Nevada.

11-13 New Mexico Petroleum Industries Committee, annual convention, Western Skies Hotel, Albuquerque.

11-16 American Chemical Society, national meeting, New York City.

14-15 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

14-16 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

14-16 National Industrial Conference Board, eighth annual marketing conference, Waldorf-Astoria Hotel, New York.

15 Natural Gasoline Association of

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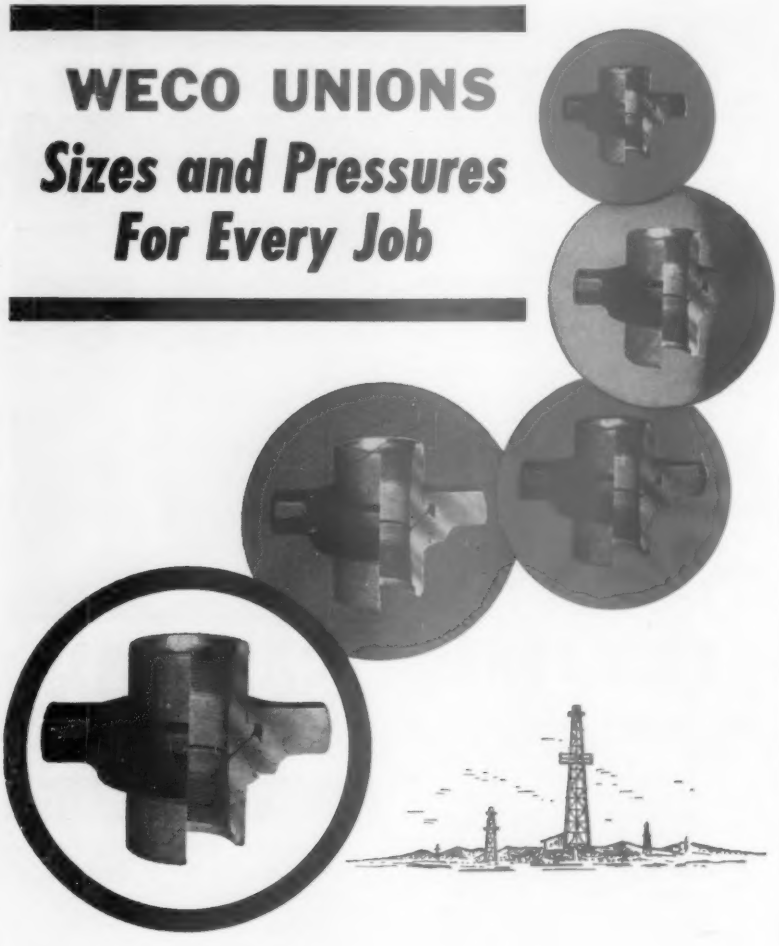

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America, Rocky Mountain regional meeting, Palliser Hotel, Calgary.

15-16 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual engineering management conference, Morrison Hotel, Chicago.

16-17 Kansas Geological Society, twenty-fifth annual field conference, northeastern Oklahoma, Western Hills Lodge, Wagoner, Okla.

18-21 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Jung Hotel, New Orleans.

19-21 Texas Mid-Continent Oil and Gas Association, annual meeting, Granada Hotel, San Antonio, Tex.

20-21 Illinois oil industry convention, sponsored by Illinois Oil and Gas Association, Illinois Oil Council, Illinois Petroleum Marketers Association, and Chicago Gasoline Jobbers Association, St. Nicholas Hotel, Springfield.

20-21 Ohio Petroleum Marketers Association, fall conference, Netherland-Hilton Hotel, Cincinnati.

21 American Petroleum Institute, Coalinga-Kettleman chapter, annual barbecue and golf tournament, Polvadero Country Club.

21-23 Pacific Coast Gas Association, annual meeting, Westward Ho Hotel, Phoenix.

25-27 American Association of Oilwell Drilling Contractors, annual meeting, Roosevelt Hotel, New Orleans.

25-28 American Institute of Chemical Engineers, meeting, Mayo Hotel, Tulsa.

25-28 American Institute of Electrical Engineers, petroleum industry committee, electrical conference of the petroleum industry, Hotel Skirvin, Oklahoma City.

26-29 American Welding Society, fall meeting, Penn-Sheraton Hotel, Pittsburgh.

26-30 Instrument Society of America, instrument-automation conference and exhibit, and fifteenth annual meeting, Coliseum, New York.

27-29 Mid-West Gas Association, annual school and conference, Memorial Union, Iowa State College, Ames.

28-30 University of Oklahoma and National Association of Corrosion Engineers, central Oklahoma section, seventh annual corrosion control short course, North Campus, University of Oklahoma, Norman.

29-30 Mid-Continent Oil and Gas Association, Mississippi - Alabama division meeting, Grand Hotel, Point Clear, Ala.

29-Oct. 1 West Texas Geological Society, field trip, Delaware basin of West Texas and southeast New Mexico.

OCTOBER

2-5 Society of Petroleum Engineers of AIME, annual fall meeting, Denver.

3-4 Independent Natural Gas Association of America, annual meeting, Fontainebleau Hotel, Miami Beach.

4-5 University of Kansas, gas-measurement institute, National Guard Armory, Liberal, Kans.

5 Society of Plastics Engineers, Inc., regional technical conference, Mark Hopkins Hotel, San Francisco.

6-7 National Association of Corrosion Engineers, annual western region conference, Sheraton - Palace Hotel, San Francisco.

6-8 National Association of Corrosion Engineers, southeast region conference, Dinkler-Plaza Hotel, Atlanta, Ga.

6-8 National Academy of Sciences, Na-

tional Research Council, ninth national clay conference, Purdue University, Lafayette, Ind.

10-12 American Gas Association, annual convention, Atlantic City.

11-14 National Association of Corrosion Engineers, northeast region conference, Prichard Hotel, Huntington, W. Va.

12-14 Southwestern Federation of Geological Societies, annual meeting, Wooten Hotel, Abilene, Tex.

13-14 California Natural Gasoline Association, annual fall meeting, Hotel Miramar, Santa Monica, Calif.

13-15 Southwestern Legal Foundation, American Association of Petroleum Landmen, second national institute for petroleum landmen, Dallas.

13-16 Taft, Calif., Oildorado, fiftieth anniversary celebration.

14-15 University of Texas, E. P. Schoch lecture series on rate processes, Batts Hall Auditorium, Austin.

14-16 New Mexico Geological Society, annual field conference, Chama basin of northern New Mexico, registration, Taos, Oct. 13.

17-19 American Society of Mechanical Engineers, American Society of Lubrication Engineers, lubrication conference, Statler Hilton Hotel, Boston.

17-19 University of Minnesota, Pennsylvania State University, Colorado School of Mines, biannual symposium on drilling and blasting, Golden, Colo.

17-Nov. 5 University of Oklahoma, School of Petroleum Engineering, short course in advanced drilling practices for engineers, University of Oklahoma, Norman.

19-20 National Association of Corrosion Engineers, north central region conference, Schroeder Hotel, Milwaukee.

19-21 Gulf Coast Association of Geological Societies, convention, Biloxi, Miss.

19-21 Rocky Mountain Oil and Gas Association, annual convention, Brown Palace Hotel, Denver.

20-21 American Institute of Mining, Metallurgical, and Petroleum Engineers, Los Angeles Basin, fall meeting, Huntington Sheraton Hotel, Pasadena, Calif.

20-23 Permian Basin Oil Show, Odessa, Tex.

23-25 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

24-25 American Society of Mechanical Engineers, American Institute of Electrical Engineers, fuels conference, Daniel Boone Hotel, Charleston, W. Va.

25-28 National Association of Corrosion Engineers, south central region conference, Mayo Hotel, Tulsa.

26-27 Armour Research Foundation of Illinois Institute of Technology, computer applications symposium, Morrison Hotel, Chicago.

26-27 Western Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.

28 Natural Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.

31-Nov. 4 University of Oklahoma, petroleum landmen's institute, Student Union Building, University of Oklahoma, Norman.

NOVEMBER

3 West Central Texas Oil and Gas Association, annual meeting, Hotel Windsor, Abilene, Tex.

3-4 American Association of Petroleum Geologists, Pacific section, annual meeting, Ambassador Hotel, Los Angeles.

3-4 Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.

6-9 Chemical Institute of Canada, chemical engineering division, conference, Quebec City.

7-10 Society of Exploration Geophysicists, international meeting, Moody Convention Center, Galveston, Tex.

14-16 American Petroleum Institute, fortieth annual meeting, Conrad Hilton, Palmer House and Congress hotels, Chicago.

14-16 Society of Petroleum Engineers of AIME, Venezuelan sections, fourth annual meeting, Maracaibo, Venezuela.

15-16 University of Kansas, natural-gas pipeline institute, Courthouse, Liberal, Kans.

15-17 Southwest Research Institute, Air Force, Navy, industry propulsion systems lubricants conference, Hilton Hotel, San Antonio, Tex.

18 Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.

27-Dec. 2 American Society of Mechanical Engineers, winter annual meeting, Statler Hilton Hotel, New York.

DECEMBER

4-7 American Institute of Chemical Engineers, meeting, Statler Hotel, Washington.

5-7 Interstate Oil Compact Commission, annual meeting, Westward Ho Hotel, Phoenix.

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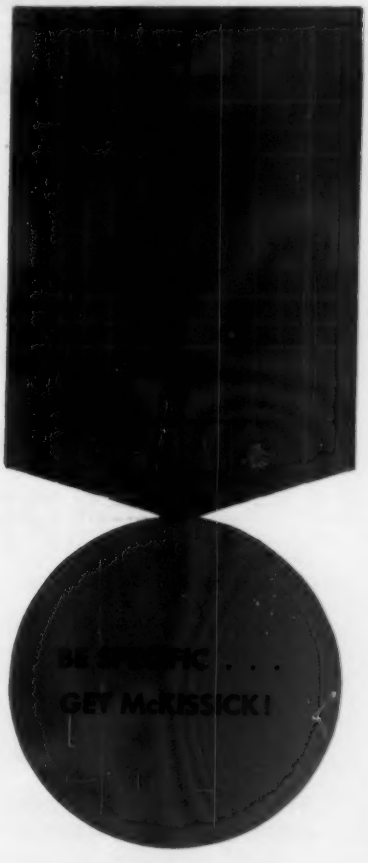

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50 years ago

September 1, 1910

A party of United States and western Canada business men returning from a tour of prospective oil areas in Alaska predict that some of the best paying investments in oil on this continent within a few years will be in that far-north territory. It reported seeing oil bubbling in borings, seepages, and several small pumping wells in the Katalla and Chilcot areas. Additional wells are now drilling.

The Texas Co. starts operation of its new six-still refinery at West Tulsa. Additions will be made without interruption. Work begins on 40-mile 6-in. oil line to connect producing properties in the Bartlesville area with the new plant.

Discovery of natural gas by Quebec Fuel Co. almost in the suburbs of Montreal is reviving interest in the limited area of undisturbed Trenton limestones in the eastern townships of Quebec.

25 years ago

August 29, 1935

Interstate oil compact gets approval of Congress in final act as session closes. Meeting of governors or representatives of states which already have ratified the pact is called for September 12 to organize an interstate compact commission. Ratifying states are New Mexico, Texas, Oklahoma, Kansas, Colorado, and Illinois.

Newly formed Valley Pipe Line Co. lays 88-mile crude-oil line from the large Samfordyce field in southwestern Hidalgo County, in Texas' Rio Grande Valley, to deepwater at Port Isabel, near mouth of Rio Grande, where sister companies, Port Isabel Terminal Co. and Valley Port Refining Co., are building a terminal and refinery. The new pipeline is the first in that part of Texas.

California faces another of its periodic crises following serious defection in its oil-curtailment program. Drastic price reductions loom in both crude and refined oil.

10 years ago

August 31, 1950

Oil industry mourns death of Frank Phillips, founder and developer of Phillips Petroleum Co. Oil pioneer dies at Atlantic City at age of 76.

Five companies join in plans for 1,080-mile 20-in. crude-oil pipeline to extend from Worland, Wyo., to the Wood River refinery area in Illinois. Participants in formation of Platte Pipe Line Co. to build and operate the line include British-American Oil Producing Co., Continental Oil Co., Ohio Oil Co., Pure Oil Co., and Sinclair Refining Co.

JOURNALLY SPEAKING

Common Problem

THE OIL BUSINESS isn't the only industry having a little trouble these days.

A stream of business magazines dealing with a wide variety of industries flows across our desk, and by thumbing through them we have gathered that quite a few industries are bothered with excess productive capacity and the disinclination of consumers to gobble up all the goods that all the companies are ready, willing, and able to sell them.

But while this problem of oversupply (or is it underconsumption?) seems to be common to all, each industry has its own way of looking at it and dealing with it.

In the oil business the entire focus is on refinery runs. If refiners would just stop running more crude than is required by the current rate of consumer demand, and stop building up such large inventories of refined products, it is argued, then the industry would be stabilized and could rock along reasonably well despite the fact that it has the capacity to turn out a good deal more oil than consumers are burning up at the moment.

The steel industry, in contrast, seems to have the situation fairly well in hand. Steel mills are running somewhere in the neighborhood of 50% of their rated capacity (compared with about 80% in oil refining). This is sad, but steel has no problem of heavy inventories at the mills.

This is because steel mills don't roll any steel until they have actual orders on their books. Now there's a switch on oil's method of doing business. What would the oil business be like if refineries didn't process any crude until a dealer signed an order for a tankload of gasoline or heating oil?

Of course the oil industry must carry rather large stocks of finished products, but still it makes one scratch his head to stand off and look at these two systems: Steel mills constantly adjusting their output to fit fluctuations in actual market demand, oil refineries running at a steady rate and piling up stocks when market demand is less than output.

Then there's the automobile industry. It's sort of in between the extremes of steel and oil in its method of adjusting output to demand. Like oil, it programs production on the basis of forecasts of demand rather than orders on the books. But like steel it constantly adjusts its production rate when demand fails to fit the forecasts.

The stocks auto makers worry about the most are those in dealers' showrooms. The automotive trade papers are full of statistics on dealers' stocks, and of reports that this or that manufacturer has shortened the work week in a plant making a particular brand of car that wasn't selling as well as had been anticipated.

Maybe we just aren't doing a good enough job of reporting, but it's seldom that The Oil and Gas Journal carries a statement by a refiner that he is cutting his runs because his brand of gasoline isn't selling very well.

And just the other day in a chemical magazine we read that many chemical manufacturers are blaming their overcapacity, heavy inventories, and weak prices on the failure of their market-research departments to do a good job of forecasting market demand.

We don't see any parallel with oil there. The oil industry has very excellent forecasts of demand—widely published, available to everybody, and checked for performance every week (e.g., see chart on page 146). In fact, we have been told by economists that no other major industry in the country has statistical controls as good as the oil industry's demand forecasts and current reports on production, stocks, and rate of consumption.

So refinery managers can hardly, in good grace, blame the forecasters for the fact that the output and inventories of refined products are higher than called for by the rate of consumption at present. They will have to find somebody else to be the scapegoat.

There's no particular moral to this story—unless you can figure one out for yourself.

Our only conclusion is that all industries have pretty much the same problem, but each one has its own method of dealing or not dealing with it.

—Henry D. Ralph

This is the new Baker Snap-Set Dual Packer

that is proving in hundreds of wells its ability to make dual-string hookups practical and reliable

To make a dual-string hookup work, you must have a dual packer that works—one that packs off and holds. Nothing defeats the economics of a dual completion like a packer that fails to set or one that leaks.

Here is a dual packer that does offer a positive and dependable packoff. It works and works well.

It is not only reliable, it is also easy to operate. You set down weight to packoff, pull up to release. Do it as many times as required for testing, spacing out or displacing.

A Baker Snap-Set Dual Packer does all the things a dual packer must do to make dual strings practical—and it does them simply and reliably.

LEFT: BAKER RETRIEVABLE SNAP-SET DUAL PACKER
It comes in two models. Model J (Product 756-J) is long-string set. Model K (Product 756-K) is short-string set. The picture shows a double-grip Model J.

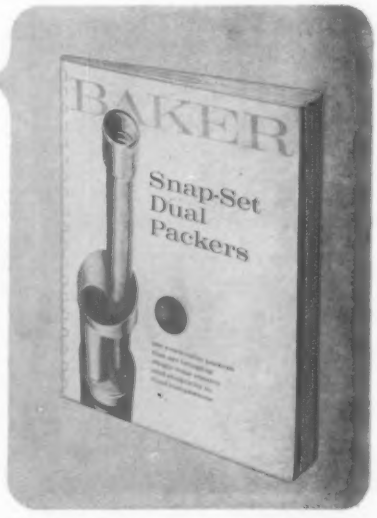
This is the new booklet that gives you the facts

Get it from a Baker man or send for it (see right)

In 52-pages—and with big pictures and few words—this informative new booklet gives you a perspective on dual completions. It also tells you the interesting engineering story behind this important new dual packer.

Here, in brief, are things the booklet talks about:

- Why dual-zone production (or injection) makes sense.
- A look at tubing and annulus completions.
- The importance of dual-string completions.
- Why a modern Baker dual-string hookup is so simple and practical.
- The seven things that make a good upper retrievable dual packer.
- The high cost of packer failures and how Baker Duals help avoid them.
- Review of an incredible series of performance and strength tests on the new Baker Snap-Set Duals.
- A review of remarkable field reports.
- How the Baker Field Service Organization works with you and stands behind every packer.
- Step-by-step schematics showing how to make Baker dual-string hookups.
- Hookup diagrams on the use of tail pipe; selective strings; selective multiples; dual-string injection; triple strings.



To get this new 52-page booklet, ask a Baker field man, or write to Baker Oil Tools, Inc., P.O. Box 2274, Terminal Annex, Los Angeles 54, California.

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BAKER **SNAP-SET DUAL PACKERS**

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Where responsible management is still not in evidence

LAST YEAR the nation's financial analysts were shaking their heads and clucking their tongues at the oil industry.

Their virtually unanimous view was that oil lacked responsible management. It seemed completely unable to adjust to changing conditions, to cope with a slower rate of demand growth, to live with surplus producing and refining capacity, or to prevent chaos in its markets.

Unless oil learned to manage its affairs better, they concluded, the industry would have continued low earnings and would be unable either to generate or attract the capital needed for modernization and growth.

LET'S SEE HOW THINGS LOOK TODAY. There is mounting evidence that some segments of the industry have heeded the advice of the experts and have accepted the realities of current conditions.

The crude-oil end of the business is far and away in better shape than it has been for several years. Producers have stopped blindly blaming all their troubles on imports and are looking inward and putting their own house in order.

Producers and state prorating bodies have accepted the fact that consumptive demand is only so many barrels per day and there is no sense in producing more. Output has been held firmly to this goal all summer.

As a result there is no surplus of crude, no distress selling, no purchaser proration, little accumulated underage, and few fields without some market outlet. And the crude-price deterioration, which was getting progressively worse until a few months ago, now seems definitely stopped.

With this achieved, producers are earnestly seeking ways to live with surplus capacity for years and still make a profit. By such ideas as wider spacing and a multitude of cost-cutting programs they are exhibiting signs of responsible management that were so lacking a year ago.

In products marketing, too, a big change is appearing. By quietly correcting many of the causes of price wars stemming from their own unwise practices, and by selectively aiming at profitable sales rather than mere volume turnover, marketers have reversed the disastrous price decline of last spring.

There seems to be a determination to clean up the chaos in marketing, to reexamine marketing methods, and to hold prices to profitable levels.

ONLY IN REFINING is there no evidence of responsible management or disposition to accept the economic facts of life.

For the past 2 months runs have been inexplicably far above anybody's estimate of need. And the resulting accumulation of excess products stocks now threatens to undermine the recent moderate improvement in products prices—the source of the whole industry's income.

Will a handful of big-refinery managers wash out the steps toward solvency achieved by other branches of the industry?

NICKEL ALLOYS PERFORM BETTER LONGER
Tubing safety valve is being readied for use in Texas well. All vital parts of the mechanism are made of long-lived, corrosion-resisting Monel alloy to assure positive shut-off if surface equipment should fail. Made by Otis Engineering Corporation, Dallas, Texas.

A wild oil or gas well is tamed by this Otis tubing safety valve. It automatically shuts off flow when wellhead connections fail. All vital parts are Monel* nickel-copper alloy to assure dependability. Monel alloy resists erosion, corrosion by sour crude or gas... makes oilfield equipment as foolproof as possible. Complete information? Ask us for "Metals To Make Petroleum Production Equipment Produce More." *Inco trademark

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Price Wars May Become Less Painful

• Mobil and Esso are taking the "fun" out of service-station price wars by cutting down on guaranteed margins. Removing the incentive for a dealer to "meet competition" is helping, at least until now.

Gene T. Kinney
East Coast Editor

MARKETERS are becoming less fatalistic about price wars as an inevitable evil of competition, and some are revising policies in an attempt to curb them.

Their stake in stabilizing chronic price-war situations is the loss of millions of dollars annually in direct revenue, not to mention the uncounted cost in dealer failures which are the despair of marketing managers.

Although price competition will always be present in a free economy, marketers appear less willing to "ride out" the seemingly senseless wars. They are becoming less patient with situations in which the refiner supplier has been sucked into tank-wagon cuts to avoid losing dealers.

They are reexamining what some consider to be "trigger-happy" policies of immediately meeting any price cut, thus making big wars out of little ones. And there are some second thoughts about guaranteed margins giving the dealer, jobber, and distributor little incentive to maintain prices.

Efforts are aimed at eliminating crosshauls of cheap product for resale outside price-war areas, volume drainage from other trade areas, and speculative inventory appreciation.

"The idea," one marketer explains, "is to take the fun"—meaning the profit—"out of price wars."

Efforts are centered around trying to restore wholesale prices as a dominant factor in retail pricing. The most notable steps have been taken by Mobil Oil Co. and Esso Standard.

Mobil plan . . . Mobil has established wide-area tank-wagon pricing in certain places.

The move was first made last October in New England where it is credited with firming up a market which has been among the most troublesome in the country. The plan has since been extended to New York (outside the metropolitan area) and the Puget Sound area of Washington.

Instead of establishing its price to dealers on the small tank-wagon circuit, Mobil has consolidated some 10 to 12 old price areas and substituted a single posting at the bulk terminal.

"A single tank-wagon price prevails in each area," explains a Mobil spokesman. "Then it is up to the individual Mobil dealer to set his own best retail price without benefit of a guaranteed allowance or margins.

"When prices are cut in a locality threatening local Mobil dealers we may reduce our dealer tank-wagon price throughout the wide area to prevent one locality from draining gallonage from the rest of the area."

Competitors have adjusted pricing and marketing patterns to meet the move, and market improvement has generally resulted. Although wide-area pricing worked in New England there is no assurance that it can be

Crude Is Tight, Prices Firm

THE domestic crude market is the tightest it's been in years. And the prospects are good the snugness will continue at least through September.

That's the report from traders, who say several refiners are making inquiries in the market place for sizable volumes of spot purchases. But there is practically none available.

This leads to speculation that:

. . . **Crude prices** will firm up, especially in regions which have sustained cuts this year.

. . . **Refiners may be forced** to reduce runs in September because they won't have enough oil to keep them on the high plateau where they've been this summer.

. . . **Refiners may start buying** products in some instances to meet commitments, thus tending to reduce present high inventories.

The higher crude-price trend already may be in the making.

Ohio Oil Co. last week restored the 15-cent cut in postings it had made on Illinois basin and southern Michigan crude back in early June. The higher price involves 40,000 bbl. daily of Illinois basin crude which now takes a top of $3 per barrel and 16,000 bbl. daily of Southern Michigan crude which now tops at $2.95.

The Ohio move followed similar ones in North Texas and Kansas earlier in the summer in which cuts in posted crude prices were restored. Crude buyers now are watching East Texas, where four different prices ranging from $3.05 to $3.25 create a confused picture. Supplies are extremely tight in East Texas with no uncommitted crude available.

Opinions differ on how much refiners will be forced to cut back in September under continued 8-day allowables in Texas. Cutbacks are sure if the 8-day pattern holds through October.

Refiners reportedly are drawing heavily on storage in many areas and it's just a matter of time until runs will have to fall unless the crude supply is increased.

It was known that at least one independent refiner on the coast had less than a day's supply of crude in his tanks.

Most marketers actually doubt that very much buying of products on the spot market will result from the developing tightness in crude. Many companies can live off product stocks for a time, especially of gasoline. What happens in distillates will depend on the weather and how long low allowables are retained.

widely applied without modification. It is still regarded as an experiment—one which has apparently pleased Mobil thus far.

Esso plan . . . Esso has used a graduated zone-pricing system in North Carolina, another chronic price-war area which has seen retail prices dip as much as 12 cents below normal.

Under this system a competitive posting is made in the price-war area, itself. The posting is increased gradually by zones outward from the price-war center.

There is no guaranteed margin for Esso dealers, giving them a bigger stake in restoring prices to normal as soon as possible.

The plan was tried in North Carolina a few years ago but was dropped because of the expense. It was reinstituted this year, successfully so this time, and the company is expected to consider it in other problem areas as the need arises.

Price-war enigma . . . Price wars will persist to a greater or lesser degree as long as price cutting is a recognized tool for building business.

The present gasoline market—under pressure from excessive refinery runs as it is—is particularly vulnerable when the following situations arise:

. . . **A new dealer** opening business wants to get a piece of the market quickly. He lures customers with prices 1 to 4 cents below the competition.

. . . **Another dealer** picks up a supply of distress gasoline. He cuts prices, keeps his normal margin, and proceeds to clean up on the quick spurt in volume.

. . . **A major cuts** the price to within a cent a gallon of the price charged by the unbranded dealer across the street. The unbranded dealer, who believes he needs a 2-cent differential to compete, reacts accordingly.

. . . **The major** sees an independent who thinks he can get along on a lower margin and is charging 3 cents less. The major cuts in conformance with a supplier-encouraged policy to keep within 2 cents of all competition.

Business starts flowing to the price cutters. Affected dealers drop prices to halt the drainage. Suppliers, to protect their dealers, cut tank-wagon prices. And the war is on.

A marketer with several stations in the price-war area takes a beating. To get even he cuts in another area where he has less at stake and where his competition stands to get hurt more.

What started as a neighborhood quarrel becomes a bitter battle with few, if any, holds barred. One marketer tries—and sometimes succeeds—in luring dealers from another with the promise of better price protection.

These patterns, with variations, are repeated with painful regularity, with most marketers considering themselves innocent bystanders, unable to keep out of a fight they didn't start and helpless to stop swinging themselves.

Phony wars . . . In addition to the classic causes of price wars there are others that are unpublicized—if not unsuspected—but which can produce the same destructive results.

Consider these hypothetical cases:

An enterprising dealer persuades a competitor across the street to cut his price. He then shaves his own price to "meet" the competition and obtains an allowance from his tank-wagon supplier.

The competitor, armed with a copy of the receipt on the tank-wagon delivery, obtains similar supplier help. And the two reap the profits of increased volume at the expense of nearby stations, plus the inventory appreciation on cheap product when they decide that the "price war" is over.

In a variation of this scheme, a jobber persuades a dealer to cut his price, which is met by the competition. The jobber gets a concession from the supplier. Both jobber and dealer load up with cheap product and make a killing when normal prices are restored. The jobber, meanwhile, has been overbuying and hauling the surplus out of the price-war area for a nice profit.

Removing the "fun" . . . This is part of what marketers have in mind when they say they would like to take the fun out of price wars.

There is neither the desire, the ability, nor the legal grounds for ending price competition.

But there is desire to avoid being trapped into selling gasoline at below cost with its consequences of revenue loss, dealer problems, and family fights which damage the industry's public relations as well as its balance sheet.

Bids for Big Gas System Going Out Soon

- Some of the biggest gas fields in western Alberta will supply gas for the 36-in. system into San Francisco. Work starts this fall, winds up next year.

PIPELINE construction will get a healthy shot in the arm this fall when work begins on the 1,404-mile gas system which will be built from the prolific gas fields of western Alberta to San Francisco.

And development drilling along the Foothills Belt should increase as producers move in to drill up locations now that they have a market for their gas.

Pacific Gas & Electric Co., chief sponsor of the system, is expected to get out bids on its portion of the line any day. PG&E hopes to get some work done this fall, but the bulk of the pipe laying will be done next year.

The system—all but 172 miles is 36-in. pipe—will move 415 million cubic feet of gas daily to PG&E. The big San Francisco utility will pay 38.7 cents per M.c.f. for the gas at the California border.

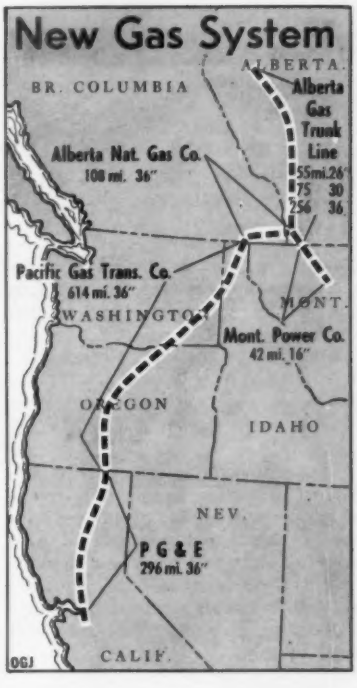
Another 151.7 million cubic feet a day will be moved down the system as far as the Spokane, Wash., area for delivery to Pacific Northwest Pipeline Corp., and Montana Power Co. will take 30 million cubic feet for delivery in northern Montana.

This will put initial deliveries at 596.7 million cubic feet daily, but there is plenty of spare capacity built into the big system. The system is designed to move 800 million cubic feet daily to Antioch, which is just outside San Francisco. This ultimate delivery would require 17 compressor stations. Only four are planned at this time.

Who's involved . . . The big system is the outgrowth of proposals made several years ago by PG&E and Westcoast Transmission Co., Ltd., the Canadian pipeline company which primarily moves gas south from British Columbia.

Originally, Westcoast Transmission planned its own system from Alberta, but later the two companies came up with the plan to move gas purchased by Westcoast through a jointly owned line.

All the gas will be gathered by Alberta Gas Trunk Line Co., Ltd., the official gathering system in the province. A second company, Alberta Natural Gas Co., will pick up the gas at the Alberta-British Columbia border and move it to the international border. Alberta Natural will be owned one-third by PG&E, one-third by Westcoast, and one-third by the public.



A third company, Pacific Gas Transmission, has been set up to move the gas through Idaho, Washington, and Oregon. Twenty-five per cent of PGT's stock will be offered to the Canadian public and the remaining 75% held by six companies.

Private ownership of PGT stock is split this way: PG&E, 50%; Blyth & Co., New York investment bankers, 9%; Canadian Bechtel, Ltd., 7%; International Utilities Corp., 7%; Northwestern Utilities, Ltd., 7%; and Montana Power Co. 2%. International Utilities and Northwestern Utilities are both parent companies of gas distributing firms in the Calgary and Edmonton areas.

PG&E will pick up the gas at the Oregon-California border and move it through its own lines to Antioch.

Gas purchases for PG&E have been made by the wholly owned subsidiary, Alberta & Southern Gas Co., Ltd.

Gas supply . . . Gas for the line will come from some of the big discoveries made in western Alberta in recent years.

The Alberta gas will also be the first Canadian gas to move into California. Another proposal to import Canadian gas is up for approval, but has not been acted upon.

El Paso Natural Gas Co., parent company of Pacific Northwest, has been PG&E's prime source of gas. El Paso has certification to sell PG&E 1.025 billion cubic feet of gas daily from Texas and New Mexico. PG&E also buys some gas from producers in California.

Until early this month, El Paso supplied California with most of its gas. Transwestern Pipe Line Co. has just begun deliveries of out-of-state gas to southern California, an area previously served exclusively by El Paso Natural.

The most northernly field tapped by the new line will be Berland River, a discovery which was hailed as one of the biggest in Canada back in 1958 (OGJ, Aug. 4, 1958, p. 53). The line will run south picking up gas near the Montana border in the Waterton-Castle River area.

Gas will also come from such fields as Westerose South (Dick Lake), Crossfield, Minnehik-Buck, Lake, Wildcat Hills, Lovett River, Kaybob, Stolberg Homegle-Rimbey, Sarcee, and several small fields.

Reserves in the fields which will be tied into the line have been estimated at 5.1 trillion cubic feet.

Gas prices . . . Alberta & Southern has signed gas contracts with 46 producers and will probably line up other producers now that the project has received final approval.

The company will pay an initial price (beginning July 1, 1961) of 14.5 cents an M.c.f. The price increases annually to 17.25 cents in 1968, then takes a jump every 5 years to a top of 21 cents in 1983. A price renegotiation clause starts in 1968 so the 5-year interval jump may change from the 21-cent high in 1983.

When the California Public Utilities Commission approved the gas imports early this month, it noted the 38.7-cent delivery price at the California border may make Canadian gas cheaper than domestic supplies. The Transwestern gas which began moving into the state recently is sold at the state border for 42 cents an M.c.f.

Union to Endorse New Wage Push This Week

• OCAW will complete vote September 1, and there's little doubt that its locals will authorize use of a strike threat in search of an 18-cent increase.

DEADLINE for petroleum units of the Oil, Chemical & Atomic Workers international union to complete voting on the union's wage program has been extended 2 weeks until about September 1.

The vote is on ratification of a program calling for 18 cents an hour wage increase. Locals at the same time will vote on a strike authorization in case negotiations on the issue break down.

The program must receive approval from 75% of the units affected to become mandatory on the entire union. Original deadline was August 15. It was extended after several large locals in strategic plants were unable to complete voting by the deadline.

OCAW President O. A. Knight reports that in the voting held so far well over the necessary three-fourths have favored ratifying the 18-cent an hour wage program.

Talks start soon . . . Knight says as quickly as the tally is completed he will direct the local bargaining units to make the necessary moves to start negotiations with management.

He expects some resistance, noting that union agents report in preliminary talks "the companies are singing the blues about how terribly poor they are."

Knight observes: "The companies seem to want to punish the workers—by holding their wages down—for the fact that there is an oversupply of petroleum and petroleum products and that the market is not booming like it used to."

The union president indicates that union bargainers will meet oil-company concern over labor costs with these statistics: In 1959 only one-eighth or 12.5% of every dollar the average oil company took in went for labor costs. In 1950, the companies averaged 15.5% of every dollar in labor costs. His conclusion is that labor costs are dropping.

A recent Journal study, however, pointed out that higher hourly wages in refining following World War II prompted heavy industry investment in instrumentation. This swing to automation resulted in the drop in wage cost per barrel of crude processed (OGJ, Aug. 22, p. 148).

In shooting for an 18-cent an hour wage increase, OCAW is aiming well above the average for wage settlements won so far this year by unions. The Labor Department estimates that during the first quarter of 1960 about 1.1 million workers have been affected by major collective bargaining agreements. More than half the workers will get increases of 9 to 11 cents an hour. About 17% got raises of 7 to 9 cents and 15% got boosts of 17 cents or more.

Threat of automation . . . The trend toward more automation in refineries and plants in the oil industry is posing a serious organizing problem for the union.

Knight says the over-all membership in OCAW is standing still. The layoffs in older groups about even up with new members won by organizers.

Throughout the international union, gradual reduction in work forces is taking place in organized groups. Layoffs of substantial numbers of men have not occurred in recent months, Knight says. Most of the reduction in force has been achieved by failure of the companies to replace men who retire or quit.

"We have to organize aggressively even to hold our own in total members," Knight says.

Emphasis in current OCAW organizing is on beefing up efforts in larger and more strategic oil and chemical plants. Small organizing drives temporarily have been deemphasized. The aim is to strengthen the union's bargaining power.

Union organizing director Carl Mattern says OCAW has won 16 organizing elections and lost six during the past few months. The victories added 1,800 members to the union. The losses involved 311 members. In addition, OCAW won a vote to retain its bargaining status at the Sugar Creek, Mo., refinery of Standard Oil Co. (Ind.).

Elections also are coming up soon at plants of Shell Chemical Co., Torrance, Calif.; Eastern States Refining, Houston; Tidewater Oil Co., Delaware City, Del.; Mobil Oil Co., Buffalo, N. Y.

Mattern says in addition the union is carrying on "seeding operations and survey work" in a number of large plants preliminary to organizing drives.

Santa Monica Vetoes Drilling

• Voters hand Mobil a 2-1 loss on its plan to drill a mile offshore. It's the second such loss in 6 years.

VOTERS in Santa Monica last week defeated a proposal which would have permitted offshore drilling a mile from the famous California beach.

Mobil Oil Co., which has a 10-year exploration contract covering 2.85 square miles in Santa Monica's tidelands, sponsored the referendum.

The proposal was to lift a drilling ban which has kept Mobil from drilling in the tidelands since it signed the contract in 1954. Had the measure passed, drilling would have been permitted a mile offshore.

This is the second defeat of the proposal within 6 years. Last week the proposal lost by almost a 2-to-1 margin. In 1954 the measure was swamped by a 4-to-1 margin.

There is a chance Mobil will drop its plans to drill off Santa Monica. The company can circulate initative petitions and take the measure to the voters one more time before the contract expires, but it may decide to cancel the contract and save the $50,000 annual rental it is paying the city.

Citizen committees were organized to fight the drilling plan. The groups centered their opposition on claims that offshore drilling would pollute the beaches and decrease property values along the recreational area. One organized group called itself the Crusade Against Oil and another the Subsurface Oil Sharing Committee.

Any revenue which would have resulted from drilling in the tidelands would have gone to harbor improvements. And the city stood a chance to make considerable money from any discovery, since Mobil's contract carries a 35% royalty rate.

Mobil had another disappointment in the Santa Monica area earlier this month. It drilled an 11,136-ft. dry hole on the Brentwood Country Club, which is just northeast of Santa Monica. The well was the first test on the 143-acre lease.

Lease-Law Changes

. . . pass Congress. White House approval expected.

CONGRESS last week passed a mineral leasing bill after House and Senate conferees agreed on minor changes to iron out differences in specific bills passed earlier by both bodies.

Sponsors of the legislation were confident that it would be approved at the White House because it has had the support of the Interior Department.

Basically, the bill makes these changes over present leasing procedures:

. . . **Combines leasing** and option acreage limits, with a total limit for both of 246,080 acres. (In Alaska, the combined limit would be 300,000 acres in each of the two areas in which the state would be divided for leasing purposes.)

. . . **Increases rentals** to 50 cents a year and eliminates second and third-year rental waivers.

. . . **Spells out** protection for innocent purchasers of leases from original leaseholders who may have violated acreage limitations.

. . . **Provides** for a new leasing system for tar sands.

. . . **Sets the primary** oil and gas lease term at 10 years.

Senate Bill Exempts Jobbers

MOST independent oil jobbers would be exempt from the overtime provisions in the extended coverage of the wage-hour bill proposed in legislation which has been passed by the Senate.

Because of differences in the House-passed bill and the Senate bill, the legislation was sent to conference last week.

The Senate version includes an amendment introduced by Sen. Strom Thurmond (D.-S. C.) which specifically exempts "any employe of a locally owned and controlled establishment engaged in the wholesale or bulk distribution of oil products, if more than 75% of such establishment's annual dollar volume of sales is made within the state in which the establishment is located."

The amendment was pushed by the National Oil Jobbers Council.

The Senate bill also exempts from coverage any service station grossing less than $250,000 a year.

Jobbers are hopeful that the House will accept the Senate version exempting them.

watching WASHINGTON

Clyde La Motte

• Will the Government get involved in oil prices? . . .

SOONER OR LATER there will have to be a decision in top governmental circles on the point at which the Government will get involved in oil prices.

You will recall that when President Eisenhower issued the original proclamation establishing the oil import-control program, he made it clear that the Government would keep prices under surveillance.

It seemed evident he wanted to reassure the public that the control program would not result in a sharp upswing in prices.

Since that time, administration spokesmen have sought to clarify this somewhat by pointing out that the President's warning should not be interpreted to mean that there should never be any oil price increases.

The question that hasn't been answered yet is what sort of price increase would prompt the administration to take some sort of action.

A delegation of industrialists and business men from New England raised that touchy question not long ago when it came to Washington to protest the 15 cents a barrel increase on residual fuel oil.

The delegation, blaming the control program for the hike, wanted the Government to do something about it.

Interior Department officials were quick to point out that the question was not within their jurisdiction. They suggested to the visitors that they go over and discuss it with the Office of Civil and Defense Mobilization. The New Englanders did so.

• OCDM faces price question on residual fuel oil . . .

THE OCDM hasn't shown any eagerness to get involved with the price question, but it did dutifully agree to take a look at the New England residual fuel oil situation.

To give it a starting point, OCDM dispatched a staff man to New England. He conferred with officials of a Boston bank which specializes in making economic surveys. The purpose: To get a line on residual prices and pricing patterns, and the factors affecting their rise and fall. In this way, OCDM hopes to be able to evaluate to some extent just what influence the control program has had on prices.

After it nails that point down, it will still need to weigh the public benefit involved in the control program. Thus, it could find that the control program caused the price hike but it could find also that this increase was offset by the defense benefits.

Obviously, all of this is going to take considerable time. At this point, it is likely that the first goal of any such price probe will be to determine whether there has been any price gouging, with import controls used as an excuse. Beyond that, OCDM will tread cautiously.

• Government is likely to seek more price data . . .

One of the major problems the OCDM is facing is its lack of data on prices. It has no method for keeping posted on the rise or fall of prices nor does it have any method for comparing the price pattern of one product with the pricing patterns of other products.

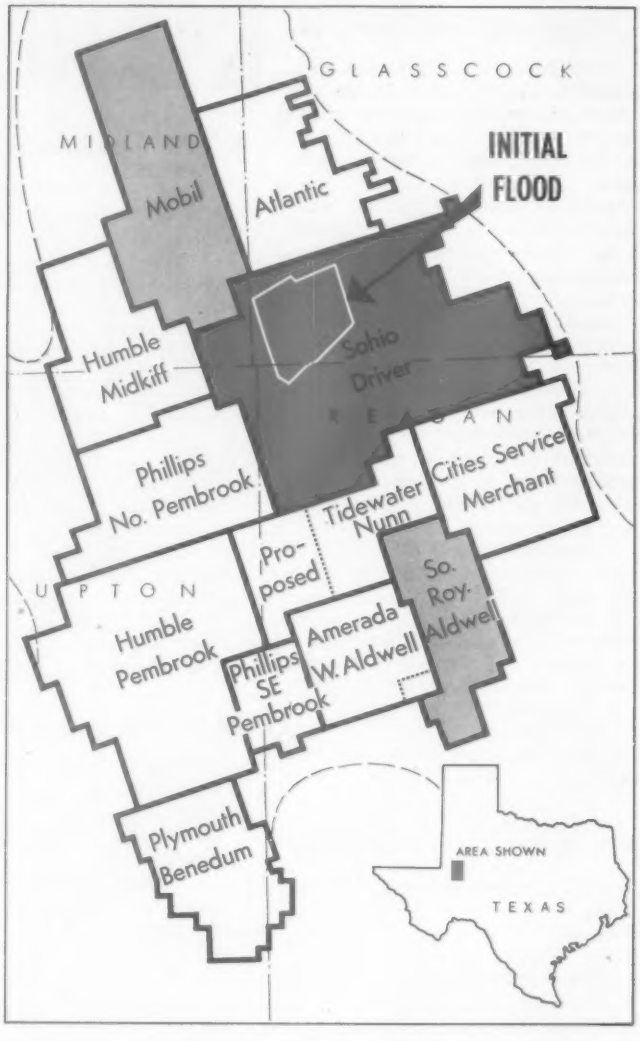
What it is trying to do now, therefore, is to develop a system of reporting which would provide it with such pricing information. Its initial effort will be to get such data from importers and major distributors.

Eventually, residual fuel oil importers may be required to make periodic price reports to OCDM.

An observer gets the impression that OCDM does not relish this chore. But its officials realize that the price question is going to arise from time to time. It knows, too, that in the matter of residual fuel oil, it will be hearing from New England if prices should rise again this winter. So OCDM wants to have some answers ready.

Texas Approves World's Largest Unit Flood

- **Initial injections in the vast Spraberry Driver unit may begin in the first part of next year.**
- **Take of oil from the highly fractured pay may possibly be quadrupled by the flood.**



THE WORLD'S largest unitized water flood, the huge 61,440-acre Spraberry Driver project in West Texas, has been approved by the Texas Railroad Commission.

The mammoth unit, with Sohio Petroleum Co. as operator, will take in 96 sections and lap over into all four Spraberry Trend Area counties—Reagan, Midland, Upton, and Glasscock.

It will easily overshadow in area even the sprawling SACROC unit in Scurry County, the dethroned titleholder with roughly 50,000 acres in Kelly-Snyder field.

The Spraberry Driver unit will affect roughly 230 leases, 280 working interest holders, and 1,315 royalty owners.

Its approval by the commission caps 3 years of continuous effort by Sohio and other operators in the area to bring it to fruition.

Just in time . . . Though the unit will not become official until probably sometime in November, the humps in the road still remaining are mostly routine formalities.

Operators now must determine which leases qualify for participation under the unit agreement. And the revisions must be filed for record in the four counties involved.

Sohio, as operator, plans to have water "going into the ground" within 3 months from the date the unit is flanged up officially.

Water injection will come none too soon. The unit area's primary oil is nearly exhausted. It has produced just under 35,000,000 bbl. to date. And Sohio estimates no more than 5,000,000 bbl. still recoverable by fighting it out to the bitter end with primary means.

The area reached its peak production in October 1952 at 25,300 bbl. per day. It was down to only 3,300 bbl. daily last spring even though 196 wells had been added since October 1952, and despite many revitalizing fracture treatments carried out after that date.

All told, Sohio and other operators completed 574 Spraberry wells in the unit area from the beginning. Of these, five have been plugged and abandoned, another 99 plugged back to shallower pays, and 103 are off production.

This leaves only 367 producing from the 6,800-ft. Spraberry zone. And of these, 196 are making less than 5 bbl. a day.

Recovery prospects bright . . . Sohio estimates original oil in place in the unit area at about 500,000,000 to 750,000,000 bbl.

It figures the unitized flood will grab off another 138,000,000 bbl. over and above primary.

Thus, the flood would roughly quadruple the production that Spraberry Driver operators have been able to squeeze out of the tight fractured pay.

Development by stages . . . Initially, Sohio will flood a 9-section or 5,760-acre area (as indicated on map). This initial development will demonstrate on a large scale the exact fracture pattern of the Spraberry in the unit area and aid in selecting the best wells over the entire unit to take the ultimate advantage of the fracture pattern.

The 9-section development will have 32 input wells, 78 producing wells, and 6 to 10 water-supply wells. The latter are each expected to yield for injection from 5,000 to 10,000 bbl. of San Andres-zone salt water per day.

The unit will inject this water by gravity flow and through a closed system on a rough 320-acre, five-spot pattern.

Initial injection rate, Sohio engineers estimate, will approach about 50,000 bbl. of water daily. This should approach injection capacity of the input wells and provide the fastest possible fill-up.

Fill-up should be attained in a relatively short time at such an input rate. And by the time it is achieved, a Sohio engineer tells the Journal, a great amount of water will have moved out into other areas of the unit so that an ultimate maximum input rate of not more than 100,000 bbl. daily is believed needed to flood the entire unit area.

Reservoir pressure in the unit area now ranges from about 600 to 1,300 psi., as compared with an original pressure of about 2,300 psi. Sohio engineers figure that gravity injection will be sufficient to hike current pressure back to somewhere around the original level.

"Blotter" project . . . The Spraberry Driver flood, like similar projects planned in the Spraberry by Humble Oil & Refining Co., Southland Royalty Co., and others (OGJ, August 1, p. 84), will take advantage of the Spraberry's water-imbibing ability as first discovered by Atlantic Refining Co. and later capitalized on by Humble in a pilot project.

The Spraberry floods will not perform using the piston-like displacement principle of conventional flood projects. Due to the very tight sand and extensive system of vertical fractures, recovery of oil by a Spraberry flood is dependent upon a blotter action by the rock. The water which is soaked up by this blotter action displaces oil in the reverse direction and into the very fractures which the water left.

This sort of action also reduces the tendency for water to channel directly from input wells to producers through the fractures.

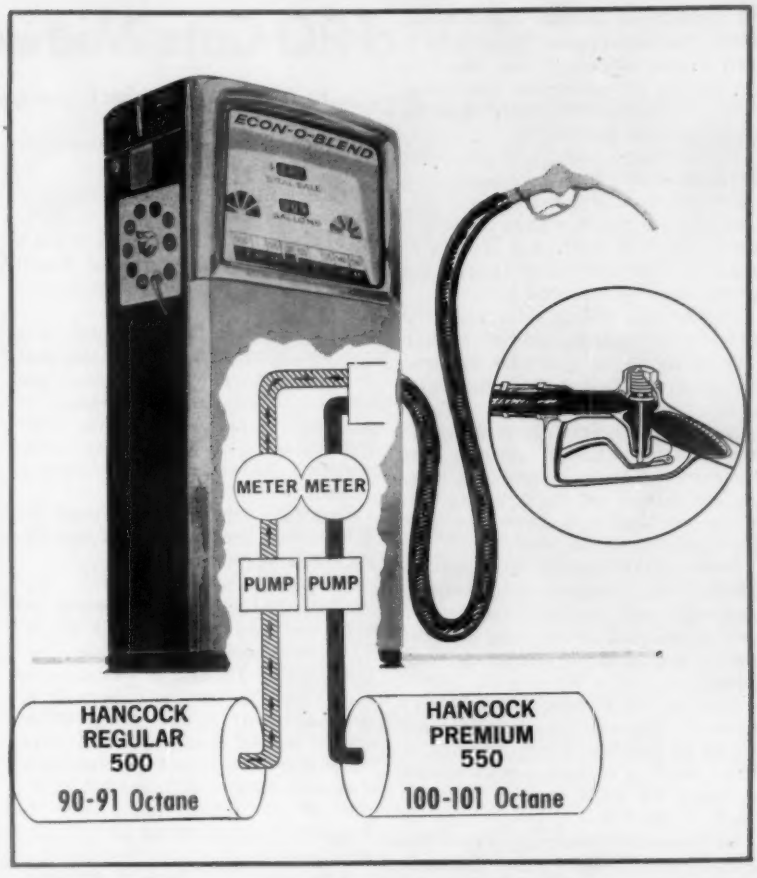
Soldotna Gets Ninth Well

OIL PRODUCTION on Alaska's Kenai Peninsula has moved a mile southwest with the completion of another producer in Soldotna Creek.

The new well, Soldotna 14-4 in Sec. 4-7M-9W, flowed an estimated 750 bbl. of 36°-gravity oil from the Hemlock zone at about 11,040 ft.

The Soldotna 14-4 is the southernmost oil well on the peninsula. But Union Oil Co. and Ohio Oil Co. have gas production 21 miles southwest of the Soldotna well.

Alaska Oil Co., Standard Oil Co. of California and Richfield Oil Corp. are major owners in the Soldotna Creek unit and in Swanson River.



Signal Converts to Multigrade

. . . completely as it introduces pump blending to the Gulf Coast. It offers seven grades between 91 and 101 RON.

THE RED rooster which is the trademark of the Hancock gasoline sold by Signal Oil & Gas Co. was crowing loudly in Texas and Louisiana last week as the company introduced multigrade marketing to the Gulf Coast.

Signal, which operates 25 stations in the Beaumont, Houston, Baton Rouge area, offers seven grades of gasoline from a single pump. The number of stations is a small factor in the retail market, but the advent of multigrade marketing in a new area is something marketing men will be watching closely.

The company laid the groundwork for moving into the multigrade field on the Gulf Coast earlier this month when it switched its stations from Starfire to the Hancock brand. Starfire was the brand name used by Eastern States Petroleum & Chemical Corp., a company which merged with Signal in September 1959.

Conversion of the Gulf Coast stations to the seven-grade pumps completes the multigrade cycle for Signal. Except for a few rural stations all of Signal's 750 outlets are now multigrade stations.

Signal opened its first multigrade stations in mid-1959 at Las Vegas, Nev. Within a few months, stations in northern California were converted to multigrade, and just 2 weeks ago the company switched its 175 stations in the Los Angeles area to the seven-grade system.

Signal plans to add multigrade stations on both the Gulf Coast and West Coast, and there is a good chance any success the company enjoys may force some of the competition to go the multigrade route.

What is offered . . . Signal's seven grades of gasoline come from blending a regular and premium grade at the hose nozzle.

The regular is rated at between 90 and 91 research octane number and

the premium at between 100 and 101 RON. No high-octane concentrate is used in the blending. Sun Oil Co., the pioneer of multigrade marketing, uses a concentrate to blend with its single grade of gasoline.

Signal's sales pitch is to sell down to customers. Each station has a chart with a recommended blend. The company suggests motorists follow the chart the first time, but it recommends the motorist drop to the next lower blend on a second trip.

"We're not selling octanes," one Signal marketing executive said. "We're trying to give the motorist maximum performance at minimum cost."

Signal's complete conversion to multigrade marketing suggests the company has been successful in making the change, but the company says it has no figures to show just how much sales have increased.

Some of the increase in sales is attributed to a stepped-up advertising campaign and expanded credit-card services adopted at the same time the change was made to multigrade marketing.

Most of the Hancock stations converted by Signal formerly sold three grades of gasoline, a regular rated at 90-91 RON, a middle premium rated at about 94 RON, and a premium rated at 100-101.

In Texas and Louisiana, Signal will market only under the Hancock brand. In its western marketing operations it also markets under the Norwalk and Bankline banners. A Signal gasoline is sold on the West Coast but by Standard Oil Co. of California. Socal bought Signal's old marketing operations in 1947 and has retained the Signal name on some of its stations.

Products for the Gulf Coast stations come from the 60,000-bbl. refinery at Houston which was acquired in the Eastern States merger. Signal operates a 15,000-bbl. refinery at Bakersfield, Calif., and is rebuilding its Signal Hill refinery which was destroyed by fire 2 years ago.

Hawk Buys Alaskan Leases

Hawk Exploration Co., Ltd., has acquired an interest in 48,000 acres in Alaska's Cook Inlet-Kenai Peninsula area from Anchorage Gas & Oil Development.

Hawk will take assignment of the leases and Anchorage will retain a working interest and royalty. Rigs, machine shops, and camp facilities at a drilling site 30 miles north of Anchorage in the Susitna Valley have been leased by Hawk. Anchorage has already drilled three wells in this area.

FPC Cuts Midwestern Rate

. . . to 6½% on project to move Canadian gas into northern United States. Transwestern accepts cut to 6¼% rate.

THE FEDERAL Power Commission has set a rate of return of 6½% on Midwestern Gas Transmission Co.'s pipeline project to serve the North Central U. S. with Canadian natural gas.

The rate of return was part of a controversy which developed this year over the FPC action in the case, and led to a congressional investigation of possible "influence" of some FPC commissioners by a company representative. However, the investigation fizzled.

Originally, the FPC approved the Midwestern project without specifying a rate of return.

Midwestern had asked for 7%, but the FPC had argued that this was too high and had recommended 6¼%. The commission, in a decision issued last October 31, said it was delaying action on the rate issue because of the uncertainty at that time over the cost of money. It said that since Midwestern could not start construction at that time anyway, it would not set the rate of return until later, after the company had completed its financing arrangements.

Last week, in a letter to Midwestern, the FPC said that in its opinion "the proper rate of return for the northern system is 6½% per year."

The FPC said the 6½% rate and the 6¼% rate it had previously allowed on Midwestern's southern system would permit an average rate of return of about 6.38% of the undepreciated cost of plant for both systems.

The effect of the FPC decision on the rate of return was to make it necessary for Midwestern to file a new schedule of tariffs, since the one previously filed was based on a 7% rate of return.

Midwestern will be required to file new rates satisfactory to the commission at least 60 days before it can commence service. As the firm has planned to begin service this fall, it is likely that it will file the new rates soon—unless it chooses to challenge the FPC action in setting a 6½% rate.

Transwestern cuts rate . . . In another rate of return issue, Transwestern Pipeline Co. has complied with an earlier FPC directive which required it to file rates reflecting a 6¼% rate of return rather than a 6½% rate.

The net result of the action was to trim the price of the gas 1 cent per thousand cubic feet. Transwestern had submitted a tariff rate, based on a 6½% rate of return, of 43 cents. The new rate, approved by the FPC, is 42 cents.

The pipeline project involved is to transport gas from Texas fields to the California border to supply the Pacific Lighting Gas Supply Co. system for distribution in southern California, principally Los Angeles.

PIPELINE BRIEFS . . .

Hearing on request of Southern California Gas Co. and Southern Counties Gas Co., to build a $44 million, 150-mile gas pipeline across southern California from the Nevada border to the Los Angeles basin, has been completed before the State Public Utilities Commission of California. The line would carry 400 million cubic feet daily, connecting with a proposed El Paso Natural Gas Co. line extending to Rock Springs, Wyo. Attorneys representing Standard Oil Co. of California and other companies protested the request.

Interior cleaning and coating of gas-transmission line is being done at the mill on order from Peoples Gulf Coast Natural Gas Co. Coating Division of H. C. Price Co. will do the job on 49 miles of 30-in. pipe at the National Tube Mill, McKeesport, Pa., and 50 miles of 30-in. pipe at American Bridge, Orange, Tex.

Natural Gas Pipeline Co. of America has been given a permanent certificate by the FPC for a $62,563,000 project increasing its capacity by 185,000,000 cu. ft. per day. The facilities, already in operation, include 490 miles of 36-in. and 21 miles of 26-in. line paralleling sections of the company's system between Fritch, Tex., and Joliet, Ill.

Trunkline Gas Co., Houston, and Mississippi River Transmission Corp., St. Louis, will get a hearing before the FPC September 7 on their proposal to spend $34,568,925 on new lines

First Oil Is Found In Sacramento Valley

TEXACO INC. has come up with a real sleeper in California's Sacramento Valley—a gas well that has started flowing oil.

It's the first oil found in the valley. Just how significant the Texaco well may be is still to be determined, but the discovery of oil in the heart of the Sacramento gas play has West Coast exploration men talking.

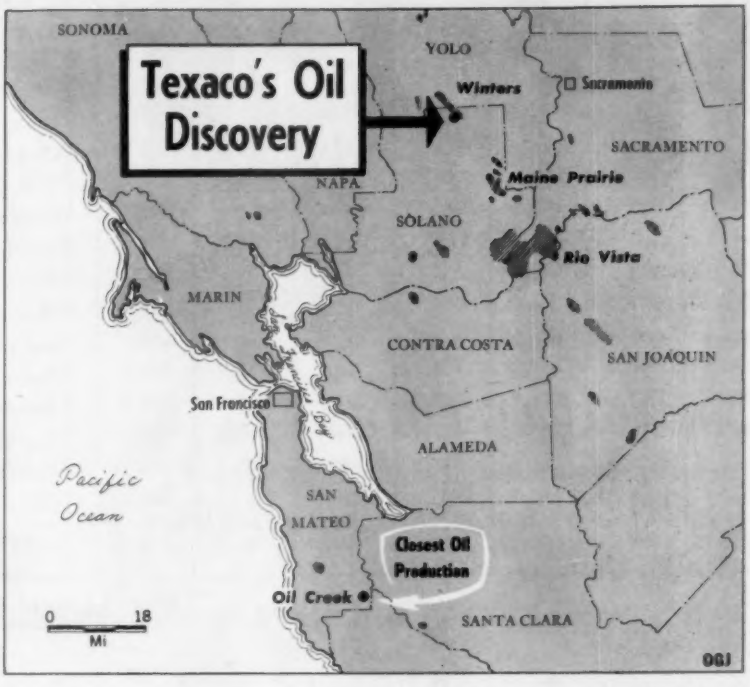
The well is the 1 McCune, near the south end of Winters gas field in Solano County and about 20 miles west of Sacramento. This is about 90 miles north of the nearest oil production at Oil Creek field and about 175 miles north of the bigger oil-producing areas in the San Joaquin Valley.

The well reportedly has been flowing varying amounts of 32°-gravity oil since April, when it was put on production after being shut in 9 months.

The flow reportedly has hit as high as 154 bbl. daily. Texaco has not confirmed the flow but has said the well has been producing small amounts of oil.

The flow is coming from two perforated intervals between 5,502-85 ft. One interval covers 9 ft. of pay, the other 13 ft. The well was drilled to a total depth of 6,000 ft. and completed September 2, 1959, as a 5,600-M.c.f. daily gas well. Gas flow was through a 24/64-in. choke.

In a brief announcement Texaco said the importance and extent of this oil discovery cannot be determined until further drilling has been done. The area of the 1 McCune is in the southern part of the Sacramento Valley, where much of California's gas search has centered in recent months.



Winters gas field, where the oil discovery was made, is about 15 miles northwest of Maine Prairie gas field, where there has been considerable drilling done this year. Pleasant Creek gas field is about 5 miles west of Winters. Dunnigan Hills is about 15 miles to the north of Winters field.

There is a gas well in Winters field just a mile north of the Texaco well. However, this well is producing from a more shallow depth than the 1 McCune. There is also an abandoned gas well about ½ mile northeast of the 1 McCune. It was drilled to 5,629 ft., which would put it below the sands producing oil in the Texaco well.

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which would extend their gathering area in Louisiana and increase deliveries to the St. Louis area.

Trans Mountain Oil Pipe Line Co. deliveries of crude in July were 91,269 bbl. per day against 113,687 bbl. a year ago. Deliveries in August were expected to drop to 70,000 bbl. per day. The July-August cutback was blamed on turnarounds at several British Columbia refineries.

A decline of almost 15,000 bbl. daily in August crude deliveries to the United States, compared with July, is forecast by Interprovincial Pipe Line Co. Interprovincial expects deliveries to the U. S. to be 50,658 bbl. daily, compared with 65,218 bbl. daily last month. However, deliveries to western Canada and Ontario refineries will increase, raising the August volume to 348,865 bbl. daily compared to 341,853 bbl. daily for July. Deliveries the first 7 months of this year were 361,816 bbl. daily against 331,313 bbl. daily for the 1959 period.

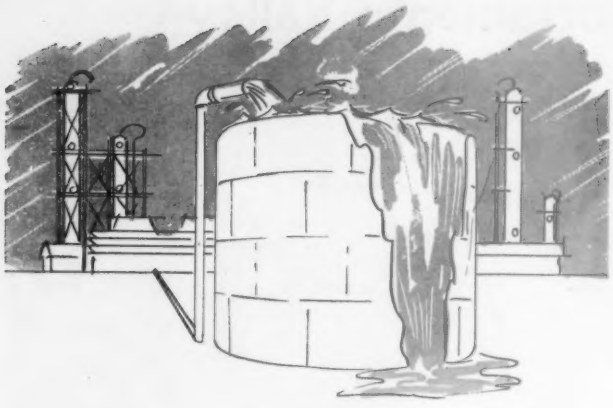
A 5-year wage agreement has been reached between the Pipe Line Contractors Association and the International Union of Operating Engineers. It calls for a 10-cent hourly increase for principal operators, 7½ cents for intermediate operators, and 5 cents for apprentice operators in 17 states effective September 6. Classifications and rates for all 50 states have been agreed to effective next January 1. At that time principal operators will get an additional 15 cents per hour and the lowest group 10 cents an hour in the 17-state area.

Savings of $3,085,517 resulted last year from the Air Force program of providing pipeline connections to bases and storage points. Now 22 bases and 20 distribution stations are served by pipelines and eight more will be added this year.

Also for Pipeliners . . .

IN THE NEWS: Bids will be taken soon on new big-inch system to move natural gas from Alberta to the San Francisco and Pacific Northwest areas (p. 47) . . . FPC allows Midwestern Gas Transmission a 6.5% rate of return on its northern leg (p. 52).

PLUS THESE TECHNICAL REPORTS: Product-pipeline terminal is remotely controlled (p. 75) . . . Current pipeline construction report (p. 104).



Despite the fact that the end of the big gasoline-consuming season is at hand, 6 of 14 major marketers show inventories greater than at beginning!*

COMPANY	CRUDE OIL		
	Stocks March 1	Desired March 1	August Report
Atlantic Refining Co.	5,443	5,555	5,561
Cities Service	8,474	8,500	7,959
Continental Oil	5,076	4,800	5,287
Gulf Oil Corp.	12,200	13,500	13,000
Humble Oil & Ref.	22,682	22,437	19,218
Phillips Petroleum	2,346	2,208	1,800
Pure Oil Co.	5,205	6,160	5,713
Shell Oil Co.	16,775	15,490	16,774
Sinclair Oil Corp.	16,187	15,000	15,500
Socony Mobil	19,403	19,263	19,053
Standard of Indiana	29,900	28,000	26,467
Sun Oil Co.	6,444	6,444	8,155
Texaco Inc.	20,807	21,100	21,094
Tidewater Oil Co.	4,367	4,263	3,627
TOTALS	175,309	172,720	169,208

*Includes some unfinished gasoline

Based on reports to the Texas Railroad Commission. Figures are in thousands of barrels.

Reports to Texas Railroad Commission show . . .

There's Enough Gasoline in Storage to

MORE statistical danger flags are flying for domestic refiners who this summer have persisted in charging crude to stills as if it were spring.

The latest warning is contained in figures on stocks given by all buyers of Texas crude to the Texas Railroad Commission for its mid-August hearing on the September allowable. It gives more evidence that refiners by overproducing are gnawing the foundation from under product prices.

The commission figures that the desired national level of gasoline stocks now is about 170,000,000 bbl. This is projected from data given by the oil companies on the desired levels for April 1 and November 1, 1960.

The April 1 desired level is 190,600,000 bbl.; the November 1 desired level is only 156,600,000 bbl. But the American Petroleum Institute estimates there is now 191,800,000 bbl. of gasoline in storage.

This means that there is more gasoline on hand now—nearly at the end of the motoring season—than the industry should hold in April before the season starts. The supply is nearly 22,000,000 bbl. or about 13% greater than it should be at this stage of the season.

Companies reporting to the Railroad Commission on their stocks as of August 1 showed total gasoline in storage at 155,591,000 bbl.—or about 81% of the API's national storage total. The commission normally does not get reports from those companies which do not buy crude in Texas. This accounts for the disparity.

Where stocks are . . . Fourteen of the firms reporting to the commission held in storage about 144,400,000 bbl. of gasoline.

That's 93.6% of total gasoline held by all.

These same 14 firms (see table) reported gasoline in storage last March 1 of about 153,600,000 bbl. and a desired total of 154,330,000 bbl. on that date.

The companies agreed that the industry's total gasoline stocks should average 193,100,000 bbl. on April 1 and 158,900,000 bbl. on November 1. This would place the winter stock level at 82.3% of the spring level. An official of one major company told the Journal he felt that industry stocks at this stage of the season should be only about 85% of the April 1 desired level.

14 companies' ideas on proper gasoline stocks

(Millions of barrels)

	Apr. 1, 1960	Nov. 1, 1960
Atlantic	202.5	167.5
Cities Service	200	168
Continental	195	160
Gulf	170	130
Humble	210	175
Phillips	180	150
Pure	195	158
Shell	190	155
Sinclair	196	162
Socony Mobil	198	166
Standard (Ind.)	200	165
Sun	185	155
Texaco	195	160
Tidewater	187.5	152.5
Composite	193.1	158.9

If applied to the 14 firms in the table, this ratio would mean their stocks should be about 131,200,000 bbl. now instead of 144,349,000 bbl.

Stocks pile up . . . A few of the big companies even have more gasoline on hand now than they would need to

GASOLINE			KEROSINE			DISTILLATE			RESIDUAL		
Stocks March 1	Desired March 1	August Report	Stocks March 1	Desired March 1	August Report	Stocks March 1	Desired March 1	August Report	Stocks March 1	Desired March 1	August Report
3,699	3,383	3,030	861	477	1,176	2,547	2,013	4,138	591	964	778
6,776	7,000	7,030*	1,104	1,000	1,174	3,900	4,000	6,516	684	750	999
4,244	4,300	3,487	235	235	395	2,630	2,100	2,434	612	600	398
15,400	16,600	16,400*	1,800	1,700	2,500	8,800	8,100	11,300	4,300	5,500	4,600
19,214	19,400	18,158	2,484	1,700	3,207	11,334	10,300	11,652	2,834	3,100	2,424
9,434	9,434	8,235	568	568	599	4,375	3,162	5,521	116	105	158
4,725	4,584	4,096	774	760	1,063	987	842	1,276	1,077	850	557
16,790	17,400	15,000	2,470	2,060	3,550	6,390	5,210	7,950	2,190	2,140	2,300
9,188	8,900	8,633	1,039	1,050	1,994	5,287	5,250	7,258	2,018	1,900	2,443
16,376	15,516	17,158*	1,581	1,460	1,552	9,847	8,701	11,457	2,274	2,509	2,171
20,364	20,222	15,450	2,512	2,229	3,770	6,286	4,418	7,830	2,132	1,990	3,075
4,952	4,952	5,034*	149	149	162	2,106	1,406	2,134	828	828	902
17,628	18,200	17,674*	Included with distillate		932	9,469	9,469	8,717	6,207	6,207	5,198
4,781	4,440	4,964*	304	285	493	4,429	3,626	4,757	1,137	800	1,523
153,571	154,331	144,349	15,881	13,643	22,567	78,387	68,597	92,940	27,000	28,243	27,526

Still much too high Indiana Standard shows good drop.

Start Motoring Season All Over Again

start the motoring season in April.

Socony Mobil Oil Co., for instance, reported 17,158,000 bbl. of gasoline in storage at the August hearing compared with stocks of 16,376,000 bbl. on March 1. The desired March 1 level is 15,516,000 bbl.

Sun Oil Co. reported stocks on hand August 1 of 5,034,000 bbl., as compared with only 4,952,000 bbl. in storage and desired as of March 1.

Gulf Oil Corp. on August 1 had 16,400,000 bbl. of gasoline, against only 15,400,000 bbl. on March 1 and a desired March 1 figure of 16,600,000 bbl.

Cities Service had 7,030,000 bbl. on hand, against only 6,776,000 bbl. March 1 and a desired March 1 level of 7,000,000 bbl.

Texaco Inc. reported its gasoline on July 1 at 17,674,000 bbl., as against 17,628,000 bbl. on March 1.

Biggest gasoline-stock drop was shown by Standard Oil Co. (Ind.), which pared a March 1 total of 20,364,000 bbl. down to only 15,450,000 bbl. as of August 1.

Other stocks . . . The commission reported crude stocks on August 5 at 241,200,000 bbl.—10,600,000 bbl. below the projected desired level for the date of 251,800,000 bbl.

Kerosine, at 30,700,000 bbl., stood 4,200,000 bbl. higher than the 26,500,000 total desired. Distillate stocks of 134,000,000 bbl. were also in surplus at 15,400,000 bbl. over the desired level of 118,600,000 bbl.

Residuals, on the other hand, were 1,000,000 bbl. lower than desired at 43,000,000 bbl.

Stocks figures submitted by the 14 companies in the table again bore out this general trend.

These firms reported holding only 169,208,000 bbl. of crude, as against 175,309,000 bbl. on March 1; 22,567,000 bbl. of kerosine as against only 15,881,000 bbl. March 1; 92,940,000 bbl. of distillates against 78,387,000 bbl. and 27,526,000 bbl. of residual against 27,000,000 bbl.

Gulf Refining Cutback Costs 625 Jobs

GULF Oil Corp. reports world-wide oversupplies of crude and products are causing it to reduce further the refinery runs and operating personnel at its Philadelphia plant.

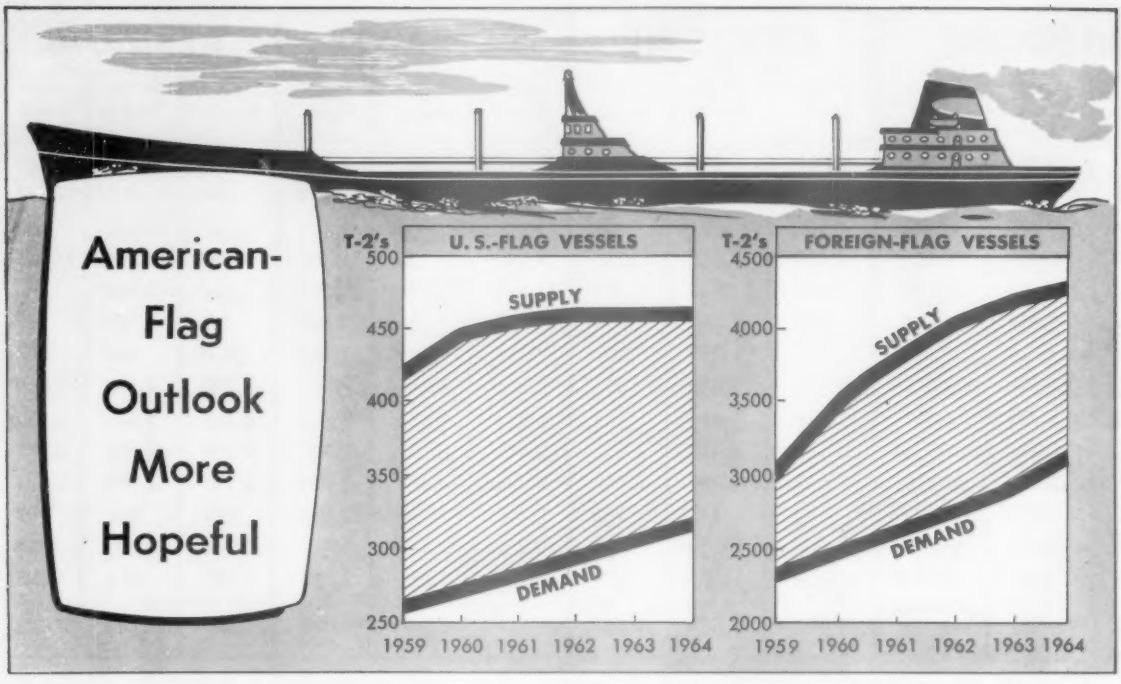
The work force will be reduced by 625 employes. A cutback of 126 workers was made at the plant last January.

In order to minimize the number of layoffs, the company is offering early retirement to all eligible employes.

Crude runs at the 193,000-bbl. refinery have been below capacity for some time, according to T. A. Dietz, refinery general manager. They are now being cut further to 120,000 bbl. daily.

Although the oversupply situation is the primary cause, Gulf officials also blame the import quota system. They declare since March 1959 the U. S. Government has reduced Gulf's import quota by more than 30,000 bbl. daily and distributed the difference among competitive refiners.

By thus encouraging these refiners to run more and more crude through their plants, in the expectation of getting larger and larger import quotas in the future, the government program aggravated an already growing supply-demand imbalance, Gulf says.



Tanker Surplus to Be Around a While

• But the nature of the world's fleet is changing. Oil companies own fewer of the new ships, which steadily grow bigger, faster, and more economical.

THE WORLD tanker surplus—aggravated by a record addition to the fleet in 1959—should be around for another 3 years at least.

In spite of record scrappings last year and a slowdown in construction, carrying capacity is still increasing faster than demand.

The prospects for American-flag vessels are more encouraging than for those of foreign registry. U. S.-flag vessels plying domestic trade routes can expect an upturn in rates toward the end of 1963. This assumes that tankers 20 years old and older will be retired.

However, even if foreign ships 15 years old and older are taken out of the fleet, supply and demand will not be balanced sufficiently to strengthen foreign charters in the foreseeable future.

This is the outlook offered in Sun Oil Co.'s annual tanker study prepared under the direction of Dr. James S. Cross. The study also reveals:

. . . **A record 238** tankers joined the world fleet during 1959, bringing the total to 3,276 aggregating 62,657,800 deadweight tons. This is equal to 3,826 T-2 tankers (a ship of 16,765 DWT capable of 14.5 knots).

. . . **Carrying capacity** increased 12.4% due to the increased size and speed of new tankers, compared with an 11.5% growth rate in the past 5 years.

. . . **Increasing reliance** on long-term charters, freeing capital for more profitable investment, was pointed up by the continuing decline of tanker ownership by oil companies.

. . . **Oil-company ownership** of U. S.-flag vessels declined from 52.8% of the total to 42.2% from 1955 through 1959, while independent ownership increased from 25.1% to 32.5%. U. S.-government ownership rose from 22.1% to 25.2%.

Present and future fleet . . . The dominance of supertankers in new construction is shown in the character of the fleet growth last year.

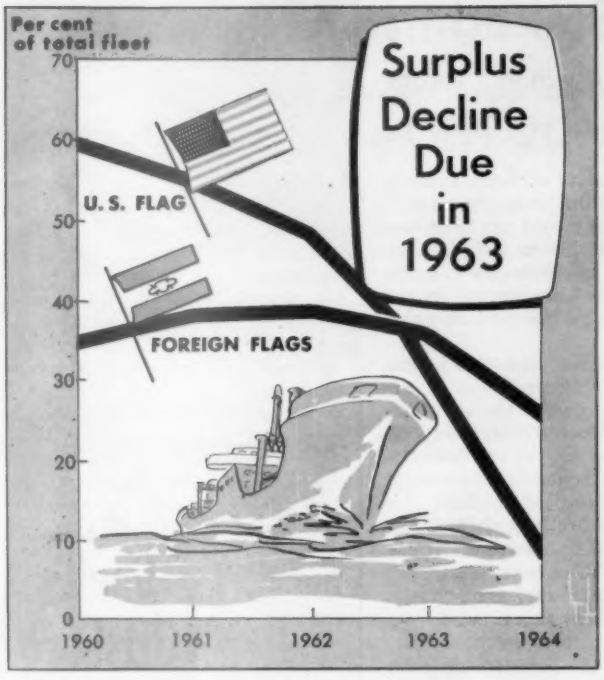
While the number of ships increased only 4.1%, deadweight tonnage was up 10.6% and carrying capacity was up 12.4%. These gains were less than 1958 because of record scrapping last year. While deliveries were slightly above the 1958 level—238 ships equal to 491 T-2's—scrappage was 2½ times the previous year at 108 vessels equal to 63 T-2's.

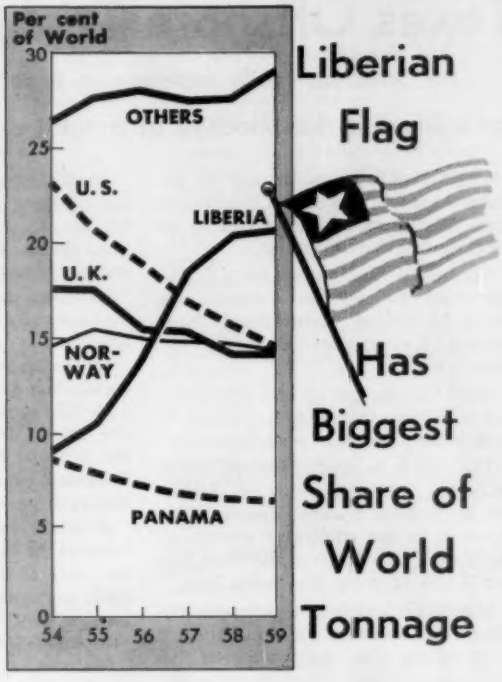
At the end of 1959 the world's shipyards had under construction or on order 523 ships totaling 19,800,000 DWT. Between September 30, 1957, and December 31, 1959, tonnage building or ordered was cut in half.

This was caused by record deliveries the past 2 years and the tanker surplus—and consequent low rates—which sharply reduced new orders. The ships on order average 37,800 DWT, compared with an average of 22,300 DWT 5 years ago.

The leading shipbuilding country is the United Kingdom, also the leading flag of registry for the new tankers.

The United States, by contrast, ranks well down the popularity list





both as a place to build ships and as an intended flag of registry.

Bigger and faster . . . The average tanker at the end of 1959 had grown in size in the past 5 years from 15,000 to 19,100 DWT. Average speed increased from 13.9 to 14.8 knots.

The current tanker is equal to 1.17 T-2's compared to the 1954 tanker at 0.8 T-2 equivalent.

Five years ago tankers 40,000 DWT and over were almost nonexistent. Last year they amounted to one-eighth of the world's carrying capacity, and the supertankers with their low transportation costs dominate future construction.

Four giants exceeding 100,000 tons have been ordered. A 104,500-ton tanker will be built in Japan, two 106,000-ton tankers will be built in the United States, and a 115,000-ton tanker will be built in Japan.

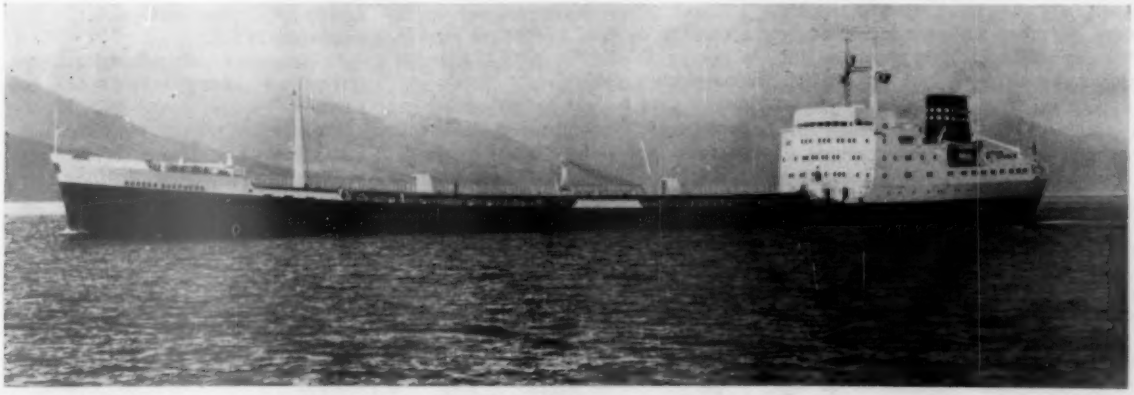
Liberia leads world . . . Under a continuation of the "flag of convenience" practice to obtain lower costs, Liberia extended the No. 1 position in registered tonnage it has held since 1957.

With the equivalent of 794.3 T-2's, it led the United States with 563, Norway 555.8, United Kingdom 555.6, and Panama 244.8. Liberia received delivery of 119 T-2 equivalents, easily the highest of the major maritime nations, but its fleet increase was the lowest in 5 years. The U. S. with 37 new T-2's and no transfers to other flags had its biggest year since 1945.

In the past 5 years Liberia has grown from a minor tanker nation with 9.1% of the world's tonnage under its flag to the leader with 20.8%.

An increasing share of American-controlled tonnage — about two-thirds—was registered under friendly foreign flags, chiefly Liberia, Panama, and the United Kingdom.

American-controlled privately owned carrying capacity flying the Liberian flag at the end of the year was almost as great as that flying the American flag.



A NEW LOOK in tankers is presented by the 19,000-ton "Border Shepherd." The vessel, the first built for British Petroleum with all superstructure at the stern, is on the Persian Gulf run. Placing the superstructure at the rear results in a small construction saving, reduced maintenance costs, and slightly lower operating costs. BP has four other similar ships on order and one which will be 35,000 tons.

Texas Offshore Test Staked

. . . by Shell on costly acreage in federal waters. Target for wildcat is the Miocene at a total depth of 10,000 ft.

OFFSHORE Texas, a vast oil potential area that has been a disappointment to drillers so far, is getting an important new drilling test.

The test is taking place on a 5,760-acre tract that sold last February for nearly $6 million, a surprisingly large amount for acreage in waters off Texas.

Shell Oil Co. put up the big money and is drilling this well. It planned to spud during the past weekend.

The well is located in Federal Block OCS-288, 31 miles south of Galveston in Federal waters. The spot location is in the southwest quarter of the tract, 2,920 ft. from the West line and 2,640 ft. from the South line.

Shell's exploration department obviously has information about the geology of the area that prompted this company to offer lease money that approaches the sums paid for tracts off Louisiana—not Texas. Last week, however, company geologists were willing to say only that the well will head for the Miocene and has a projected total depth of 10,000 ft.

Zapata Off-shore Co.'s mobile rig, the Vinegarroon, will drill the well in 65 ft. of water. The job should be completed in 3 to 3½ weeks.

The area . . . One of the big surprises of the federal lease sale held in February at New Orleans was the renewed interest in Texas.

While drilling has boomed in the highly productive tracts off Louisiana, there have been few discoveries and only lackadaisical interest off Texas.

But the February sale attracted $35.7 million in high bids for 48 tracts. Of this amount, $10,267,000 went for two adjacent tracts where Shell is drilling. Other tracts in the area cost only $100,000 to $300,000.

Shell itself has six adjacent blocks, including the two expensive ones. Continental Oil Co. and the combine of Socony-Gulf-Pan American also has tracts in the immediate area, and these companies will be watching closely Shell's drilling effort.

Shell is calling the area in which these tracts are located the "Buccaneer area."

The wildcat is the third farthest from shore ever drilled off Texas. In 1956 Shell and Continental jointly drilled two dry holes 63 miles off Sabine Pass in water depths of 80 and 90 ft.

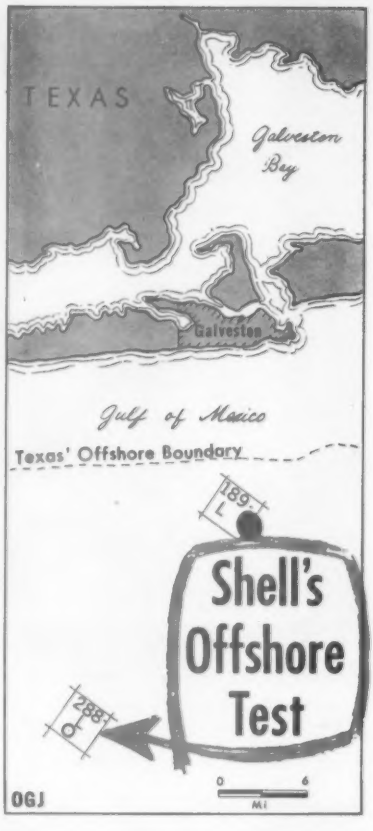
Shell's interest in offshore Texas is not confined to the "Buccaneer area." Of the 48 tracts sold in February, Shell bought 23 of them and paid $23 million. Most of those outside the "Buccaneer area" are located to the southwest, off Freeport, Brazoria County.

The company is now the largest leaseholder in offshore Texas. It has 134,482 acres, nearly all of which are located in federal waters beyond the 3-league line and lie off Brazoria, Galveston and Jefferson counties in waters from 40 to 135 ft. deep.

The oil industry has drilled 172 wells in the Gulf of Mexico off Texas, and only 13 of these have been classified as wildcat completions. There have been 102 dry holes and 57 development wells.

Wildcatting has been widely scattered off Texas and only a few fields have been found. Fewer than a half dozen exploratory tests have been drilled this year.

Eleven offshore fields have been discovered. This total does not include offshore extensions of four coastline onshore fields. Only five of the offshore fields have produced oil. Texas' first commercial offshore field, Chevron which is off Kleberg County, was discovered in 1954. It now has about 35 wells.



Oil's Fringe Benefits Are the Most

A STUDY of fringe benefits paid by various industries and businesses shows that the average oil employe gets more such benefits than any of the others.

These fringe payments add up to 83.6 cents an hour for the oil worker, a survey by the U. S. Chamber of Commerce reveals.

The next highest for any other industry or business group is 70.1 cents an hour, and the average for all the 1,064 big and little firms included in the Chamber's survey is 54.8 cents an hour.

In terms of per cent of the total payroll, fringe benefits paid by the 18 oil firms covered in the survey amounted to 28.3%. The average for all industry 22.8%.

Thus, for every $100 the oil employe receives in wages, the employer pays $28.30 in fringe benefits.

The $28.30 is spent as follows:

Company payments for social security, unemployment compensation and other legally required employe benefits, $3.

Private pension and insurance programs, separation pay, and other agreed-upon payments made by the employer, $12.20.

Paid vacations, sick leaves, holidays, rest periods, lunch periods, and other payments for time not worked, $11.10.

Profit-sharing payments, Christmas and other bonuses and similar payments, $2.

The Chamber survey also shows that the cost of fringe payments has risen sharply in recent years. For 108 companies included in the first such survey in 1947 and in the one for 1959, the fringe costs doubled.

You can get a copy of the Chamber's complete report on "Fringe Benefits 1959" by writing to the Economic Research Department, Chamber of Commerce of the United States, Washington, D. C. Price per copy is $1.

Government Leasing Booming

- **Production from federal leases is now above 700,000 bbl. daily. It's more than double the rate in 1950.**

THE HUGE—and growing—stake the federal Government has in petroleum is emphasized in current statistics on the amount of acreage the Government has under oil and gas lease and the value of production from those leases.

As of June 30, the U. S. Geological Survey reports, the Government had under lease 125,111,966 acres, an increase of about 7.5 million acres over the same date in 1959.

This included 521 Gulf offshore leases covering 2,114,049 acres, an increase of almost 700,000 acres over the previous year.

Production from federal leases in all categories in 1959 was 259,987,236 bbl. By contrast, the total in 1950 was 103,080,267 bbl.

The 1959 production rate is equivalent to more than 700,000 bbl. daily. This is slightly more than 10% of the current U. S. production of 6,828,550 bbl. daily.

The dollar value of production of all products from federal leases in 1959 was $829,026,480, with royalties to the Government of $111,910,375.

In 1950, the value was $260,075,663, with royalties of $30,034,142.

The biggest gain has been in the Gulf offshore areas. From 1953, when the value of all offshore production (including sulfur) was $5,036,861, the production shot up to an estimated value in 1959 of $143,133,000.

For the federal Government, this brought a hike in royalty revenues from $967,892 in 1953 to an estimated $25,787,700 in 1959.

(The offshore figures include production and revenues from the disputed zones but not from state-owned Zone 1.)

The cumulative total paid to the federal Government through the years in lease rentals, bonuses, and royalties was $746,756,953 as of June 30 of this year.

This included $64,183,297 in royalties, $22,277,185 in tax royalties (to equal state taxes), $37,368,224 in rentals, and $621,961,788 in bonus payments.

Aside from the offshore area, the biggest expansion in leasing activity in recent years has been in Alaska.

On December 31, 1950, there were only 35 leases in Alaska, covering 77,805 acres. On June 30, 1960, there were 16,547 leases covering 34,908,143 acres.

Most of the remaining leasing is in the western states, where the federal Government has large holdings of public lands and controls the leasing of Indian lands.

Thus far, there is no indication of any slowdown in the pace of federal leasing. Rather, Geological Survey officials anticipate a continuing rise in the immediate years ahead.

This is good news, of course, for Uncle Sam. It means more money in the federal till.

U. S. Oil-Gas Leases

State—	No. leases	Acreage
Alabama	123	34,628
Alaska	16,547	34,908,143
Arizona	4,055	3,930,626
Arkansas	620	534,987
California	4,881	1,794,356
Colorado	14,088	11,508,083
Florida	176	295,891
Idaho	420	618,681
Illinois	17	4,443
Indiana	12	4,165
Kansas	509	134,472
Kentucky	14	14,657
Louisiana	618	260,810
Maryland	4	3,816
Michigan	97	22,407
Mississippi	1,916	890,940
Montana	11,163	8,044,290
Nebraska	295	140,168
Nevada	2,934	1,260,975
New Mexico	15,112	11,595,134
North Dakota	3,083	1,447,950
Ohio	10	2,582
Oklahoma	7,474	789,284
Oregon	545	392,410
Pennsylvania	1	192
South Dakota	1,348	1,149,036
Texas	106	46,730
Utah	30,033	18,906,281
Virginia	12	19,089
Washington	116	38,613
West Virginia	115	150,074
Wyoming	42,165	24,054,004
Totals	158,609	122,997,917
Offshore:		
Florida	23	132,480
Louisiana	434	1,703,649
Texas	64	277,920
Totals	521	2,114,049

(Note: The leases include federal public lands, acquired lands, and Indian lands under federal supervision.)

Helium Bill May Not Make It This Session

HELIUM LEGISLATION ran into snags last week which threatened to prevent its passage during the current session of Congress.

However, Interior Department was pressing hard to get the legislation cleared in order to encourage more industry participation in helium recovery. In their contacts with congressmen, Interior officials were terming the helium bill as the most important legislation the department is seeking in Congress.

Earlier, it had seemed virtually certain that the proposed bill would be approved, setting the stage for construction of at least 12 helium plants to extract helium from natural gas. The House passed the legislation and sent it to the Senate. That is where it ran into trouble.

Sen. John Carroll (D-Colo.) has been the most vigorous opponent. His opposition has been based largely on a clause of the bill which would bar Federal Power Commission consideration of helium revenue in establishing natural-gas rate bases.

Carroll also maintained that since major government negotiations would be involved in contracts for plant construction, the matter should be delayed until next year to give the new administration a voice and to provide more time for study of the legislation.

Some adverse newspaper publicity also tended to slow action on the bill, and a controversy arose over whether—if the FPC is to include helium profits in gas rate making—the proportion of costs should be assessed on the value or the volume of the helium involved.

On a volume basis, the amount of helium would be insignificant when compared to gas volumes. On a value basis, however, the costlier helium would become a larger factor, thus having more impact on gas rates.

The eventual solution of differences over the legislation appears to depend to a large extent over how long Congress will remain in session. If Congress decides to close shop soon, the helium bill probably will die on the vine.

Louisiana Offers Credit for Wide Spacing

- September 28 hearing planned on proposed order making spacing above 40 acres a factor in setting allowables. Increase could be 50% on 80 acres.

LOUISIANA has taken a tentative stride toward making wider well spacing a factor in the formula for fixing oil allowables.

The stride is not as long as the industry had proposed—but it certainly is headed in the right direction.

James H. Gill, the new conservation commissioner, issued a proposed order on the subject and set a hearing for September 28 at Baton Rouge to hear pro-and-con arguments. He will then issue a permanent order.

Here is what Louisiana proposes:

... Wells drilled in new pools on a spacing pattern of more than 40 acres would get an allowable progressively greater than the one presently based solely on depth.

The maximum increase would be 50% on a maximum spacing of 80 acres. This does not limit spacing to 80 acres, but anything greater than that would get no allowable premium.

... The increase for offshore and onshore wells would be the same in terms of barrels produced. In terms of percentage increase, offshore wells would not get as much as onshore.

... The order would apply only to pools developed after the effective date of the order, although exceptions may be allowed for pools recently developed on a pattern of more than 40-acre spacing.

... Wells drilled on less than 40-acre spacing would be penalized below the present depth bracket allowable. A well on 20-acre spacing, for example, would be cut 25%.

... Exceptions for wells on less than 40-acre spacing would be granted for those in complexly faulted structures, but the burden of proof concerning the nature of the structure would lie with the operator.

... The order would not apply to stripper pools or to wells of less than 3,000 ft.

The effect ... Louisiana officials hope the proposed order will be strong enough to encourage wider-spaced drilling while, at the same time, allaying fears of royalty and landowners that their interest would suffer.

Several major companies, including Continental Oil Co. and The California Co., asked in a hearing last May that the formula be changed to double the allowable for wells drilled on 80-acre spacing instead of the basic 40 (OGJ, May 30, p. 64).

By proposing only a 50% increase, Commissioner Gill is giving only half a loaf.

Tom Winfiele, chief engineer and top adviser to the new commissioner, said, however, he is expecting "considerable accord" in the industry.

"This is a little more modest step, but what we are proposing seems to fit the suggestions of the industry," Winfiele said.

He intimated that the 80-acre maximum could be revised upward "down the road" and pointed out that the proposed order does not actually limit spacing to that figure. It does, however, grant no extra allowable for spacing above 80 acres.

He emphasized also that allowables for wells in established fields would not be affected by the order. They will continue to get allowables based on the depth bracket alone.

The only exceptions to this rule will be for recently developed fields where the conservation department can be shown that higher allowables are justified because of spacing in excess of 40 acres. The proposed order may have to be amended, to define this exception better, Winfiele said.

At present the order reads: "As of the effective date of this order there probably exists some pools which have been penetrated by only several wells. The commissioner should have the authority to classify certain of these pools as new pools should the operators ... be able to show evidence sufficient to justify a new pool classification."

Offshore wells ... The proposed order may bring some grumbles from offshore operators.

In drafting the formula, the department is allowing offshore wells an increase equal to—not greater than—onshore wells. Because of higher production costs, offshore wells now get a higher depth bracket allowable.

Winfiele said the department takes the position that the extra cost factor already is figured into the offshore allowable and that to grant a new increase based on the old—and higher—allowable would be giving "two premiums." Hence, in figuring the higher offshore allowable for wider spacing, the onshore allowable will be used as the base to figure from.

The formula ... In practical figuring, the Louisiana proposal means that an onshore well's allowable is based 50%

PROCESSING BRIEFS ...

World's largest alkylation unit will be built at American Oil Co.'s Texas City refinery by Fluor Corp. The 14,600-bbl. unit is a major part of an extensive modernization program which includes a 150,000-bbl. crude unit and a 47,600-bbl. catalytic cracker. The units are expected to be completed by early 1962.

Propane-recovery facilities now being installed at Texaco's Lawrenceville, Ill., refinery will be completed about November 1. The company will sell the product to distributors in the area.

Increasing use of regular gasoline and credit cards is shown in a survey of American motorists by Du Pont. Of those interviewed, 24.5% said they used oil company credit cards, compared with 18% in 1956. Regular gasoline was the choice of 58.2%, up 8.2% from 4 years ago.

A $3 million, 3,000-bbl. daily hydrofluoric alkylation unit has been completed at British American's Clarkson refinery, west of Toronto. It includes a feed preparation system, two fractionating columns, acid contactors, and a 154-ft. isostripper tower. Procon (Canada), Ltd., were general contractors and offsite construction was handled by Horton Steel Works, Ltd., and Humphreys & Glasgow (Canada), Ltd.

High-density polyethylene facilities are being added to Phillips Chemical Co.'s Houston plant to raise the production about one third to a total of 100 million pounds annually. The entire expansion program will be completed in 1961.

Average octane number of gasolines sold across the nation in July remained unchanged from June, the monthly survey by Ethyl Corp. shows.

on well depth and 50% on acreage (up to 80 acres).

The acreage base is 40 acres. Under the proposed formula, a well on 40 acres would get the same allowable as it does on today's depth-bracket allowable. The two factors—acreage and depth—balance each other 50-50.

If the well has a productive area, or spacing pattern, of more than 40 acres (up to 80), the allowable is figured by adding the appropriate depth-bracket allowable to the following: The onshore depth-bracket allowable, multiplied by one-half, multiplied by a fraction, the numerator of which is the number of productive acres in excess of 40 and a denominator of which is 40.

Here is an example for an onshore well with 60-acre spacing, a depth bracket of 10,000-11,000 ft., and a depth-bracket allowable of 102 bbl. The equation would read: 102 plus (102 times one-half times twenty-fortieths) equals 127.5 or 128 bbl.

For an offshore well with the same spacing and depth bracket, the depth-bracket allowable would be 168 bbl. The equation would read: 168 plus (102 times one-half times twenty-fortieths) equals 142.5 or 143 bbl. Note that the figure 102 represents the onshore, not offshore, allowable.

To figure the reduced allowable of an onshore well drilled on less than 40-acre spacing, it is necessary to subtract from the appropriate depth-bracket allowable the following: The depth-bracket allowable, multiplied by one-half, multiplied by a fraction, the numerator of which is the number of productive acres less than 40 and the denominator of which is 40.

The equation for a well on 20-acre spacing with a depth bracket of 10,000-11,000 ft., and a depth-bracket allowable of 102 bbl. would read this way: 102 minus (102 times one-half times twenty-fortieths) equals 76.5 or 77 bbl.

New allowable . . . While working on revised allowable formula, Commissioner Gill last week announced the September and October allowable based on the old depth formula.

The production rate remains at 33% of the base period, but over-all production is expected to rise by 6,318 bbl. daily to a total of 968,056 bbl. daily. The increase will be due to new production.

The increased output is 50 to 100% lower than that of recent months, and Winfiele said this may be due to the restrictions placed recently on multiple completions.

Major producers on August 10 expressed their opposition to the restrictions which grant newly completed wells only one allowable. Commissioner Gill expects shortly to decide on any changes needed.

Arizona to End Rules Mixup

ARIZONA operators won't get a new set of field rules and regulations until around the first of the year.

The oil and gas conservation commission plans to readopt a set of rules similar to the 1959 rules which were invalidated by an attorney general's opinion. He held the rules received faulty publication notices.

Hearing on readoption will be held in December or January. Meanwhile, the commission will authorize drilling and producing operations under the 1951-52 regulations. They permit drilling for oil on 40-acre spacing. The 1959 regulations specified an 80-acre minimum. Both set 640-acre spacing for gas wells.

Only one permit for oil has been issued since June, and that went to Humble Oil & Refining Co. The commission says it expects from 20 to 40 applications for gas wells in the Pinta Dome helium area of Northeast Arizona the next 4 months.

D. A. Jerome, Phoenix, commission executive secretary, says operators applying for permits for oil wells in the intervening period will be advised of the temporarily unsettled spacing problem.

Attorney General Wade Church this month advised the commission that the Arizona Weekly Gazette, the newspaper in which the 1959 rules notices were published, has been determined to be a "newspaper of general circulation in the state." As such, it can be used in the future for legal notice publication. However, since the decision is not retroactive, a new hearing on rules will be held for readoption.

Weighted average for premium was 99.4 while regular was 92.5. Compared with a year ago, the premium average was 0.3 octane number higher and regular was 0.5 higher.

Delhi-Taylor has completed a two-tower distillation unit at its Corpus Christi refinery to produce orthoxylene and other chemicals. The unit was designed and major construction work done by Delhi-Taylor. Orthoxylene will be separated from a high-purity mixed xylene stream. It now is in demand for production of phthalic anhydride, used in polyester plastics, and vinyl plastics.

A fire in the pump room of the catalytic cracking unit at Utah Oil Refining Co.'s Salt Lake City refinery killed two employes and caused $250,000 worth of damage. Rebuilding of the unit is under way. The plant will operate at 50 to 65% of capacity while the unit is out of service.

New tetraethyl and tetramethyl lead plants will be constructed at Beaumont, Tex., for Houston Chemical Corp., by Singmaster & Breyer. The new plants, which will cost $10 million, are expected to go on stream by September 1961. Completion will make Houston Chemical the third company to manufacture TEL and TML. Only companies now in the field are Ethyl Corp. and Du Pont.

A joint company is being organized by Shell International Chemical Co., Ltd., London, and National Distillers & Chemical Corp., New York, to produce and market polyolefin film and packaging materials outside the United States and Canada. Head of the new company will be Dr. W. L. J. De Nie, currently a senior executive of Shell Development Co., New York. He will make headquarters in London.

A cumene plant with an annual capacity of 70 million pounds has been placed on stream at Texaco's Eagle Point plant in Westville, N. J. The raw materials for the cumene are propylene and benzene.

Also for Refiners . . .

IN THE NEWS: Major marketers are moving to take the profit out of price wars by new methods of pricing (p. 45) . . . OCAW units expected to endorse union's program for 18-cent an hour wage boosts in balloting this week (p. 48) . . . Signal introduces multigrade marketing of gasoline on the Gulf Coast (p. 51) . . . Gasoline stocks on hand now are sufficient to start the motoring season—too burdensome for the season's end (p. 52).

PLUS THESE TECHNICAL REPORTS: H-oil process improves quality of distillate feed (p. 80) . . . Wax technology faces some changes (p. 89).

There'll be more attacks, of course, but . . .

Don't Look for a Cut in Depletion

Clyde La Motte
Washington Editor

THERE APPEARS to be a growing feeling in some oil circles that it is just a matter of time until oil's percentage depletion will be slashed.

There are competent oil observers in Washington who hold this view. Some predict privately that this will happen within the near future, perhaps as early as next year and quite likely within a year or two thereafter.

The most frequent guessing along such lines is that percentage depletion as applied to a company's foreign operations will be the first to go.

The next step would be to trim application of domestic percentage depletion, perhaps on a graduated scale so that the larger companies would be the hardest hit.

The final step then, according to this theory, would be a reduction of all oil percentage depletion to, say, 15%.

In making such an analysis, observers seemingly give little weight to the current presidential campaign. That is, they feel that the move to trim percentage depletion will go forward no matter who is in the White House.

They do point to the Democratic platform's reference to percentage depletion as a tax "loophole," although they concede that the platform does not specifically mention oil.

And they feel that the Republicans may have left the door open at least for a cut in foreign percentage depletion in its pledge to continue to provide incentives for development of *domestic* sources of minerals and metals.

Even more important to observers, however, is the tax picture generally. There is little doubt that government expenditures will increase, not decrease, in the immediate years ahead.

This means that more tax revenue will be needed. Rather than take the politically unpopular action of hiking personal income taxes, Congress is more likely to use the approach of closing tax "loopholes," and Congress can write its own definition of the word "loophole."

Realistic approach . . . Despite the negative factors outlined above, the flat prediction is made here that oil's percentage depletion will not be cut in the foreseeable future.

This is not wishful thinking, but a careful analysis of the facts of life.

In the first place, no change will be made in oil's percentage until a careful study has been made by Congress.

The "quickie" attacks on depletion that have been launched on oil before will be attempted again and again—but with the same unsuccessful results as in the past. That is, there is little real danger that foes of depletion will be successful in such future maneuvers.

Bear in mind that tax legislation must originate in the House.

This rules out any Senate tax action, other than as a "rider" on some non-tax bill.

Even should such a rider affecting percentage depletion clear the Senate, it would have to be taken up by the House. And the House, jealous of its authority, is traditionally slow to look with favor on such Senate maneuvers.

So the odds are heavily against a "quickie" depletion cut.

Presenting facts . . . The oil industry has always won when Congress made a study of percentage depletion, thus giving good reason to believe that future studies will yield similar results.

For example, the House ways and means committee last year launched a long, detailed study of the federal tax structure with the aim of trimming out unfair taxes and closing loopholes.

A part of that study covered percentage depletion. A panel discussion of industry and other tax experts was held before the committee in a public meeting.

Dr. Richard Gonzalez, of Humble Oil & Refining Co., and Scott Lambert, of Standard Oil Co. of California, represented the oil industry. The chief attack came from college economics professors who were on the panel.

It was obvious that Gonzalez and Lambert made a very favorable impression upon the congressional committee with their clear-cut explanation of how percentage depletion operates and why it is needed.

They did such a good job, in fact, that the committee decided last February that it would not be necessary to make any further probe or hold further hearings on oil's percentage depletion. The vote in the committee was almost unanimous.

Therefore, when the powerful House ways and means committee makes its recommendations on tax changes—probably early next year—the recommendations will not include any proposed change in depletion for oil.

Because of this, any "quickie" effort to cut percentage depletion will run into the hard fact that the ways and means committee studied the issue carefully and found no fault with the present method. For oil, this committee action is far more important than the anti-oil remarks some congressman may make on the floor of the House or the Senate.

Future challenge . . . Of course the membership of the ways and means committee will change from time to time, so the views of the current group will not necessarily be the views of a later group.

The important point, however, is that no tax change is likely to occur without the normal procedure of hearings and tax committee study. This tends to insure the oil industry that it will be given an opportunity to present its story.

As long as the industry is able to do a competent job of presenting the logic of percentage depletion, the danger of a cut is slim indeed. For, despite occasional impressions to the contrary, most congressmen are intelligent, hard-working, and fair-minded individuals.

This does not mean, of course, that the industry can relax and ignore all threats to percentage depletion. Such a course would be ruinous.

But it does mean that if the industry does a good job of telling its story to other industries, other business groups, the general public, and to Washington, percentage depletion will continue to survive the periodic attacks that are certain to be launched against it from time to time.

Iraq Dickers for More Oil Profits

- If the government wins a bigger slice of the net, other countries in the Middle East can be expected to press for the same thing. Other major issues in bargaining with IPC concern concessions and local refining.

THE STANDARD 50-50 profit split in the Middle East may be in for its most serious assault since it came into effect in the early 1950's.

The challenge is being leveled by the Iraq Government in negotiations now in progress with Iraq Petroleum Co. It is based on the grounds that recent contracts in the Persian Gulf area have outdated the 50-50 formula.

The revision in oil payments is believed to be one of the key points in talks going on in Baghdad in which Iraq is seeking to increase both its oil revenue and its influence over oil operations.

The meeting was planned before the recent round of Middle East price cuts went into effect, but the reductions probably won't help IPC's bargaining position.

Neither side is issuing any comments on the course of the talks. The first item on the agenda reportedly was an increase in port dues at Fao, Iraq's only terminal on the Persian Gulf. An arbitrary increase by the government in July caused a tempest in a teapot. Incoming tankers turned away from the port, forcing a temporary shutdown at Rumaila field. The port is now open (OGJ, Aug. 8, p. 66).

The Fao question, however, is believed a warmup for the bigger issues, including relinquishment of some concession areas and local refining by IPC, as well as a revision in the profit formula.

If the 50-50 split should give way in Iraq, it would almost certainly be revised in other major Middle East-producing countries.

Moves cautiously . . . Premier Abdul Karim Kassim is moving on a carefully set stage in Baghdad.

He has recalled from abroad one of the country's ablest negotiators to participate in the talks. This is Muhammad Hadid, former finance minister who resigned his cabinet post last April after a dispute in his party. He now leads his own political group, the National Progressive party.

Others on the government team include Dr. Tala'at al-Shaibani, minister of planning and acting minister of oil; Abd al-Latif al-Shawwaf, minister of commerce; Brigadier Taha al-Shaikh Ahmad, director of planning at the Ministry of Defense; Abd al-Fattah Ibrahim, head of the General Petroleum Authority; Nadhim al-Zahawi, governor of the Central Bank; and Dr. Mustafa Kamil Yasin, director general of the political department in the Ministry of Foreign Affairs.

The IPC counterparts around the table are G. H. Herridge, managing director; N. M. Eskerdjian, executive director; and F. C. Ryland, chief representative of IPC and associated companies in Iraq.

Premier Kassim also is taking pains to keep emotionalism out of the talks.

He set the tone for the meetings in a recent speech in which he emphasized that: "We have prepared ourselves to discuss each problem in a peaceful and fair manner. We do not wish to encroach on the rights of others, but we shall seek to secure our rights through peaceful negotiations; . . . patience is the means to success."

What Iraq wants . . . The premier has not spelled out his objectives in public, but the Baghdad newspaper, Al-Thaurak, which closely follows his views lists six major demands that probably are the starting points of negotiations. These are:

. . . **Relinquishment** of all concession areas not now developed by IPC and an increase in production.

. . . **Reconsideration** of the 50-50 profit-sharing formula in light of recent agreements in Iran and Kuwait providing for state participation or higher profits, or for a 60% share of production in kind, regardless of production costs.

. . . **Freezing** of French interests in IPC and allocation of French profits to Algeria or other Arab countries struggling for independence.

. . . **Division of membership** on the board of directors equally between Iraqi and parent company members.

. . . **Increased training** for Iraqis abroad in oil affairs.

. . . **Supervision** and audit of company accounts by the government.

Hadid's views . . . While the premier's newspaper lists the major issues, Hadid's press outlet, Al-Bayan, lists several side issues designed to chip away at IPC revenue.

These include treatment of exploration and drilling costs as operating expenses written off every year, rather than as capital expenditures written off at 5% per year. Another point is a charge that IPC owners are not making use of Iraqi Maritime Transport Co. tankers.

Further subjects are a demand for a refund of a cost-of-sales discount now withheld, and a charge that too few Iraqis are employed by IPC.

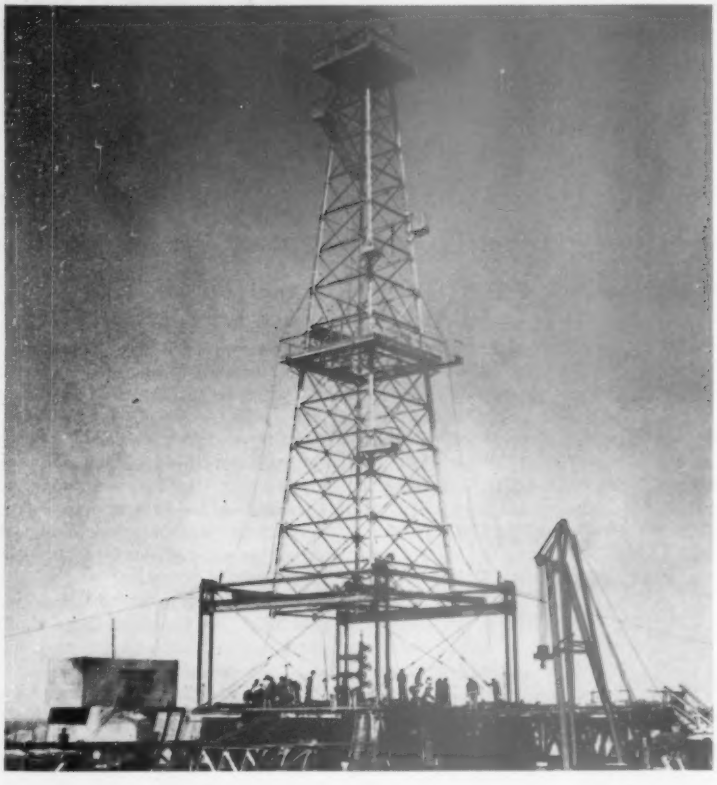
Hadid's party has taken a strong stand against a rival political group which is calling for a profit split based on Venezuela's new tax formula. This view is pushed by Al-Ahali, of the National Democratic Party.

First Underwater Completion Made

THE WORLD'S first underwater completion has been successfully carried out off the coast of Peru.

Peruvian Pacific Petroleum, a subsidiary of Cities Service and Richfield Oil, is producing 200 bbl. daily from an offshore well through a special wellhead installed 132 ft. below the surface. The equipment was installed by divers.

Crude from the well, Humboldt 3, is flowing through a 6,200-ft. 3-in. aluminum pipeline to storage on shore. The well is on an 800,000-acre offshore concession covering proven and prospective oil lands acquired by the company 2 years ago.



Soviets Rig Down

THESE TWO pictures illustrate a novel—if not unique—method of moving off a completed well as practiced by Russian-Romanian drilling crews at work for the Indian Government in the Cambay region north of Bombay.

The Iron Curtain drillers apparently build, and tear down, their rigs from the bottom up.

The photograph at the left shows the top 115 ft. or so of a normal drilling derrick apparently suspended in midair on a complicated square hoisting frame. In the picture on the right, the stub-derrick has been lowered to the rig floor and workmen are swarming over the lower two sections, unbolting them, preparing to move the derrick off the completed well.

Note the heavy concrete foundations at the left of the second photograph and the number of lines reeved on the block at the left of the picture. These multiple-string blocks on all four corners of the frame are apparently used to raise the derrick for the addition of new sections on the bottom when building the rig and lower it for tearing down—again from the bottom.

This rig, at the second successful well

French Want to Hunt for Oil in India's Kutch and

- The Institut du Petrole would explore two areas under a program similar to those already sponsored by the Russians and Romanians.

FRANCE is offering to carry out an exploration program on a contractual basis for India.

The government's Institut du Petrole would carry out the work under the supervision of the government's oil and gas commission rather than as a concessionaire. This would resemble the program now being carried on by Russian and Romanian experts.

The Institut wants to supply equipment and personnel and train Indian technicians for an oil search in the Kutch region of Gujarat State and along the Coromandel Coast of South India. It is offering to supply $8.4 million in foreign exchange in a program that would cost $12.6 million. Repayment would be in 6 years at 6% interest per year.

The French also are offering to set up an oil institute for India either at Dehra Dun, headquarters of the oil and natural gas commission, or at Ankles War, Publi sector, where indications of oil were recently found.

Seek bidders . . . The French offer comes at a time when the government is trying to attract private investment and is also carrying on exploration on its own.

The latest word from New Delhi, however, is that the government is setting terms that companies may find hard to swallow. It reportedly wants something better than a 50-50 profit split with all crude production sold to the government at a stipulated price.

The government stand ties in with its continued dissatisfaction with the price of oil imports. Despite reductions of more than 11% on the laid-down price by Burmah-Shell, Stanvac and Caltex, India still believes imports should cost no more than prices quoted by the Russians.

Companies reportedly are trying to tie any further substantial cuts on crude and products imports to new exploration concessions and permission to expand their existing refineries.

Order pipeline gear . . . While companies and the government may be at loggerheads in New Delhi, fast progress is being made on a 750-mile pipeline project in northeastern India. The 14-in. and 16-in. system from the Nahorkatiya producing area to refineries at Nunmati and Barauni is being built by Oil India Private, Ltd.

A total of 51 engines has been ordered from W. H. Allen Sons & Co. of England. Thirty will be used in pumping stations and 21 will be used for power generation. Dual-fuel engines will be installed in dispatching stations at Nahorkatiya. These are designed for either diesel or natural gas operation. Downline engines will be straight diesel.

Several technical problems had to

from Bottom Up

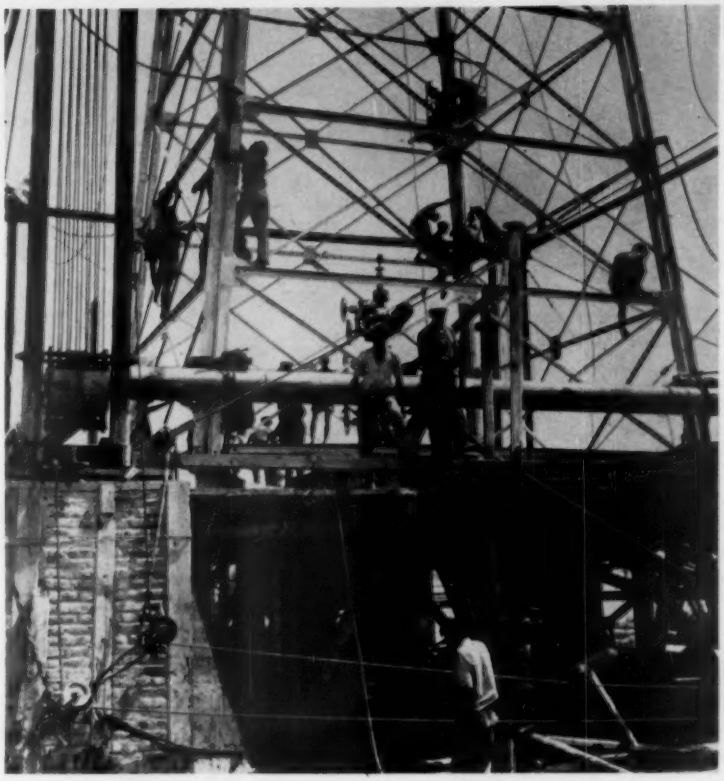
completed at Lunej near Cambay, has already been dismantled to the point well above the normal "window" on the side of the derrick to accommodate pipe strings.

This complicated from-the-bottom-up system of rigging up won't be necessary when two new, modern National T-45 jackknife masts recently purchased here reach the area (OGJ, July 18, p. 138).

Cambay drilling . . . The well pictured here, about 1 mile east of the Lunej discovery, flowed oil, gas, and water at what has been described as "very high pressure."

The 45 Russians, 35 Romanians, and 300 Indian workers in the Cambay area have drilled six of these wells and two more locations are staked in the program to drill 14 more by the end of this year.

The Indian Government has never divulged the pertinent data from tests made of the Lunej wells except that the wells ranged in depth from 5,900 to 6,560 ft. with both oil and gas sands found between 4,300 and 5,620 ft. The third well completed tested 4,000 M.c.f. of gas daily.



Coastal Areas

be overcome in designing diesel engines to operate on Nahorkatiya crude including a low 22° F. flash point and a high content of gas that sets at 85° F.

Pumping will be continuous once the line is in operation. Flow will be controlled from the field with the help of radio telemetering lines. Three diesel alternator sets will be installed in each station.

Motorized flow valves in the input and output side of each station will enable bypass of the oil flow in an emergency.

Another British firm, Murphy Radio,, Ltd., will design and build a 36-channel radio link. Telemetering control will be carried on over one speech channel while 35 other speech channels will connect stations along the line.

The system will move up to 55,000 bbl. daily when it goes into operation.

Development drilling is still in progress at Nahorkatiya where No. 67 has just been drilled in 10 days. The thirteenth well is in progress at nearby Moran where 8 out of the first 12 wells were producers.

Lowest Price Set on Neutral Zone Heavy

HEAVY Neutral Zone crude is being offered at the lowest publicly posted price for oil in the producing history of the Middle East following a price reduction by two more companies in that part of the world.

Getty Oil Co. announced new price postings effective August 9 for the oil it ships from the Saudi Arabia-Kuwait Neutral Zone. The company posted a new low of $1.27 a barrel for the 16.5-17.4°-gravity eocene oil, a cut of 3 cents per barrel from the previous price and a new low for any Middle East crude. The Eocene oil from the Neutral Zone is far heavier than any other oil produced in the entire Middle East region.

Getty Oil cut prices on its other two Neutral Zones 4 cents a barrel. New price for Burgan 23.5-24.4°-gravity is $1.40 a barrel.

The Neutral Zone is now producing about 130,000 bbl. daily which is divided equally between Getty and American Independent Oil Co. The two own half interests in the concession.

Two days before the Getty announcement, Gulf Oil Corp. revealed that it has posted slightly higher new prices than those announced earlier for Shell and Esso. Gulf's new prices for Kuwait and Iranian crudes match those posted a week earlier by BP and Mobil (OGJ, Aug. 22, p. 62).

New Pay Is Found in Pakistan Field

A NEW oil horizon has been confirmed in Pakistan's Dhulian field, one of the mainstays of the country's small production.

Dhulian 39, a long stepout, has flowed 650 bbl. daily on prolonged tests. The crude is slightly heavier than the 36 and 45°-gravity oil produced in two higher zones.

Attock Oil Co., the operator, is drilling a stepout 1½ miles to the west and it is deepening a well on the north flank of the structure that was dry in known pays.

Dhulian for several years produced from the Laki horizon ranging from 7,500-8,000 ft. Since 1952, most of the 2,700 bbl. daily has been from the Ranikot horizon, ranging from 8,000-8,700 ft.

Tariki Sees Price Cuts as Aid to Arab Unity

• The Saudi Arabian's reaction to reductions in Middle East postings is somewhat mild. Hotter words are expected at the Arab Oil Congress.

RECENT PRICE cuts in the postings for Middle East crude may do more to unify the Arab producing countries than all the previous efforts of leaders to get the governments together on a regional oil policy.

This was implied last week by Shaikh Abdullah Tariki, director general of Saudi Arabian oil affairs, who has been unexpectedly restrained in his reaction to the price cuts. Western observers were inclined to read a little wishful thinking into Tariki's hope that the price cuts may spur divergent Arab nations to unite.

Long a nominal spokesman for Arab oil, Tariki has been fighting an uphill battle to prorate Middle East production to markets and thus insure firm prices. Tariki's plan for proration of Middle East production in cooperation with the same type of effort in Venezuela, is counter to the desire of individual Arab oil-producing countries to increase production continually to secure more revenue.

Last week in Beirut he called the price cuts an "unfair and arbitrary action taken unilaterally without consulting the producers concerned." And Tariki pointed out that the Arab Oil Congress in Cairo last April passed a resolution which would require consultation with producing countries before any change in prices is made.

His words did not carry the sting that might have been expected from an outraged Arab official facing a cut in revenue which he himself estimates at between $25 and $30 million.

He said the price cuts gave the Arab countries a "unique opportunity" to get together and show the companies "that they cannot surprise the producers with price cuts which ruin their economies."

The mildness of Tariki's comments last week indicates the Arab producing countries may hold their fire on producing companies until the second annual Arab Oil Congress in Beirut in mid-October. The subject of prices for Middle East oil and their link to government income will be an important item on the congress agenda.

Tariki rejected the theory expressed by Esso Export that offers of Russian oil at low prices partially influenced the price reduction. Tariki said the Russians are offering no more than 100,000 bbl. daily in world markets outside the iron curtain and contended that this volume is not enough to justify a price cut in Middle East oil.

The Arab oil leader's figure of 100,000 bbl. daily is just about one-third of actual Russian shipments to free world markets last year. Another 200,000 bbl. daily went to satellite nations.

Tariki complained that the Middle East's posted prices were "false" even before they were cut. He says prior to the cuts prices were pegged to the price of Caribbean oil plus freight to New York and the normal destination of most Persian Gulf crude is Europe and not the U. S.

Sun, Superior Hurt By Venezuela Discount Ban

TWO OF Venezuela's Lake Maracaibo newcomers have been cast in the unwilling role of guinea pig for the rest of the industry in the tussle between posted prices for crude and the price a buyer is willing to pay.

The two, Sun Oil Co. and Superior Oil, were still walking a tight wire last week in an effort to sell their crude and at the same time avoid a crackdown from the government because of the price tag.

The rest of the industry watched carefully to see just how the two companies will deal with a new government policy which the industry questions from a legal standpoint and feels is contradictory at times.

The two are probably as vulnerable in the present situation as any companies operating in Venezuela. Each made large investments to get lake concessions. Each found sizable commercial oil just in time to hit the worst market slump in modern oil history. Each has been warned by the government that current sales are too far below posted prices. Neither has ever posted a price for its Venezuelan oil.

Superior shutdown denied . . . Both Minister of Mines Dr. Juan Pablo Perez Alfonzo and Howard Keck, president of Venezuelan Superior's parent U. S. company, denied last week that Superior was shutting down because of government pressure.

The minister called a Caracas press conference to score persistent rumors that Superior was laying off all its employes and planned caretaker operations of its properties until the oil market improves.

While Superior officials in Venezuela said nothing, Dr. Perez Alfonzo told the press flatly that not a single Superior employe has been laid off. The minister blamed the whole rumor on a Maracaibo labor leader whom he described as "a notorious comrade."

In Los Angeles, Keck said as far as he is concerned there's "nothing unsettled in Venezuela."

The Superior president said the Venezuelan company is producing about 30,000 bbl. daily from its Lake Maracaibo properties and "is meeting our contracts for crude from Venezuela."

Early this month, and about the time the oil minister was verbally spanking the companies for selling at a discount, Superior was producing oil at record levels reaching more than 82,000 bbl. daily.

Last week Keck would not confirm speculation that Superior's oil was being discounted as much as $1 a barrel in Venezuela. But he did say:

"We would be moving a lot more oil if we were selling cheaper than our competitors."

He declined to give the destination of the crude which Superior is shipping from Lake Maracaibo, but most of it is believed to be coming into the U. S.

Sun's position . . . Sun Oil officials in Philadelphia last week were still watching the Venezuelan situation closely and declined to comment.

In contrast to this watchful, waiting attitude on the part of Sun, Dr. Perez Alfonzo told the Caracas press that Sun had been able to "work out a compromise" with the government.

Like Keck, Sun officials declined to comment on reports from Caracas that its recent discounts to Petrobras, in exchange for Brazil's waxy Bahia crude, amounted to as much as 75 cents a barrel. The volume involved is small, amounting to about 2,000 bbl. daily.

A new look at the

CONSTANT PER CENT DECLINE CURVE

explains some long-standing discrepancies

The usual definition of decline is not the actual decline involved in the constant-per cent decline curve. For constant-per cent decline, the loss ratio for 1 year or 1 month is widely used as yearly or monthly decline respectively. Unless the loss-ratio method is applied very carefully, serious errors can result.

BY K. E. GRAY

. . . reservoir engineer in Sohio Oil Co.'s headquarters engineering group in Oklahoma City. He has recently been in the Mid-Continent division office of the same company. Prior to joining Sohio, he was a drilling engineer for the California Co. at Venica, La. He holds both the bachelor's and master's degrees in petroleum engineering from University of Tulsa.

A CONSTANT loss ratio for any time unit is proof that a constant-per cent decline is operative. But the loss ratio is not the actual decline of the exponential or semilogarithmic decline curve.

Let's define terms. Loss ratio is the loss in rate over a given time interval expressed as a fraction or percentage of the beginning rate for that period. For example, a well on constant-per cent decline producing 1,000 bbl. per month at the beginning of the year and 750 bbl. per month at the end of the year has a yearly loss ratio of 0.25 and is said to have a 25% per year decline. On this basis the loss ratio can be no greater than 100%. An equivalent definition for yearly loss ratio is one minus the ratio of succeeding years' production.

True decline is a constant fraction or percentage of a steadily decreasing rate. The reference rate is the instantaneous rate existing at any time, and the **true decline can be greater than 100%.** True decline is the basis for the often-used rate-time plot on semilogarithmic paper and the rate-cumulative production plot on cartesian paper. And it determines the slope of both plots.

Here's the problem. In 1927 Johnson and Bollen[1] introduced the loss-ratio method of extrapolating decline curves. The meaning of their work was reported by Pirson[2] in 1935. Arps,[3] in his "Analysis of Decline Curves," uses monthly loss ratio as monthly decline. For constant per cent decline, the loss ratio for any time unit is a constant, and the use of this ratio for declines is rather widespread. However, some engineers, in using this definition of decline, have noted that for known initial and final rates and cumulative production the calculated time interval will not agree with the time that has actually elapsed. Or, the calculated cumulative production will not agree with the actual production for known initial and final rates and time interval. This is because of a fundamental difference between loss ratio and true decline.

Because true decline is the mathematical basis for the usual rate-time and rate-cumulative production equations or their graphical forms, it seems desirable to derive these equations at the start. They will show the relationships among rate, time, decline, and cumulative production as well as the graphical significance of those terms.

Derivation of Equations

For constant-per cent decline the rate of change of instantaneous production rate with respect to time is equal to a constant fraction of that rate. Or:

$$Dq = -\,dq/dT \qquad (1)$$

Where:

D = fractional decline, a constant
q = instantaneous production rate at time T

Separating variables and integrating,

$$\ln q = -\,DT + C_1 \qquad (2)$$

At time $T = 0$, the production rate is the initial rate, q_i, and:

$$C_1 = \ln q_i \qquad (3)$$

Then:

$$\ln q = -\,DT + \ln q_i \qquad (4)$$

$$\ln \frac{q}{q_i} = -\,DT \qquad (4a)$$

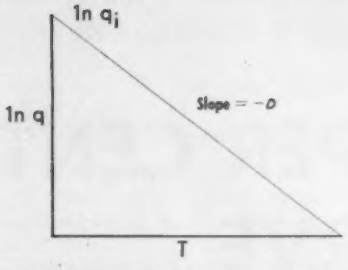
$$\frac{q}{q_i} = e^{-DT} \qquad (4b)$$

Solving Equation 4a for D and T:

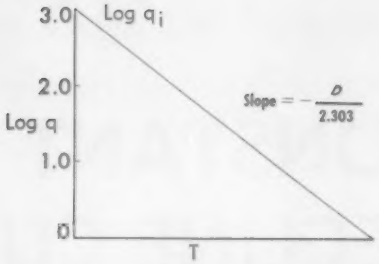
$$T = -\frac{1}{D}\ln\frac{q}{q_i} = \frac{1}{D}\ln\frac{q_i}{q} \qquad (4c)$$

$$D = -\frac{1}{T}\ln\frac{q}{q_i} = \frac{1}{T}\ln\frac{q_i}{q} \qquad (4d)$$

Cumulative production equation. The cumulative production, N_p, resulting from a constantly decreasing production rate, q, for a given time period, T, may be obtained by integrating Equation 4b.



CARTESIAN PAPER PLOT of natural log of production rate vs. time is a straight line with intercept ln q_i and slope $-D$. Fig. 1.



CARTESIAN PAPER PLOT of base 10 log of production vs. time is a straight line with intercept log q_i and slope $-D/2.303$. Fig. 2.

$$N_p = \int_0^T q\,dT = \int_0^T q_i e^{-DT}\,dT \quad (5)$$

$$= -\frac{q_i}{D}\int_0^T e^{-DT}(-D)\,dT$$

$$= -\frac{q_i}{D} e^{-DT}\Big]_0^T \quad (5a)$$

$$N_p = \frac{q_i}{D} - \frac{q_i}{D} e^{-DT} \quad (5b)$$

But $q = q_i e^{-DT}$. Substituting into Equation 5b gives:

$$N_p = \frac{q_i - q}{D} \quad (6)$$

Where:

N_p = cumulative production during time interval that production rate is declining from q_i to q
q_i = initial rate
q = rate at time T
D = constant decline fraction

Consistent units must be used in Equation 6. If q_i and q are in barrels per month, then decline must be in per cent per month. Rates in barrels per year require decline in per cent per year.

Graphical Relationships

In Equation 4, $\ln q = -DT + \ln q_i$, it may be seen that a plot of ln q versus T on cartesian paper is a straight line with an intercept of ln q_i and a slope of $-D$, Fig. 1.

Changing to base 10 logarithms:

$$\log q = -\frac{D}{2.303}T + \log q_i \quad (7)$$

Fig. 2 shows that a plot of log q versus T on cartesian paper is a straight line having an intercept of log q_i and a slope of $-D/2.303$.

More commonly used is a plot of q versus T on semilog paper with q being plotted on the log scale as shown in Fig. 3. Note that in plotting q in this manner, the log of q is taken in the process. In calculating the slope, however, it must be remembered that **the variable is log q and not q.** Thus, the slope of the plot is:

$$\frac{\log q - \log q_i}{T - T_1} = -\frac{D}{2.303} \quad (8)$$

Using the difference in rates rather than the difference in the logarithms of the rates is a common error in calculating the slope of the rate-time curve. The resulting loss in rate, say for 1 year, referred to the rate at the beginning of that year yields the yearly loss ratio. The decline, D, can be conveniently obtained by reading the time difference for one cycle on the q scale, for which the difference in logarithms is unity and as shown in Fig. 3:

$$-D = -\frac{2.303}{\Delta T} \quad (9)$$

The basis for a plot such as Fig. 3 is the definition of constant per cent decline as given in Equation 1.

Rate - cumulative production curve. Rewriting Equation 6 as:

$$q = -DN_p + q_i \quad (10)$$

shows that a plot of q versus N_p on cartesian paper is a straight line of slope $-D$ and intercept q_i, Fig. 4. The slope will be consistent with units for rate. If q is in barrels per month, decline will be in per cent per month, etc. For an arbitrary economic limit, cumulative production can be read directly from the plot.

Quite often cumulative production, or reserves, are obtained from a plot as Fig. 3 from the area under the curve. For this process the **true decline, D, is operative** because it determines the slope of the line.

Relationship Between Monthly and Yearly Decline

Consider the ratio of production rates for decline in per cent per month for several months or in per cent per year for the same time period in years:

$$q/q_i = e^{-dt} = e^{-DT} \quad (11)$$

Where:

q_i = rate at beginning of time period
q = rate at end of time period
d = decline rate, %/month
t = time interval in months
D = decline rate, %/year
T = time interval in years

The ratio q/q_i is the same whether each rate is expressed in barrels per month or barrels per year. Therefore the exponents of e in Equation 11 must be equal. That is:

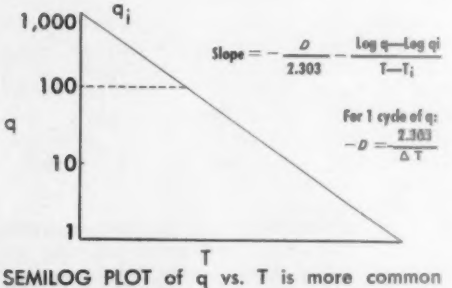
$$dt = DT \quad (12)$$

Since $T = t/12$:

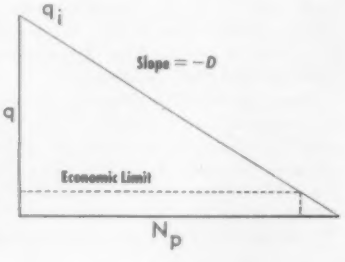
$$dt = Dt/12$$

$$d = D/12 \quad (13)$$

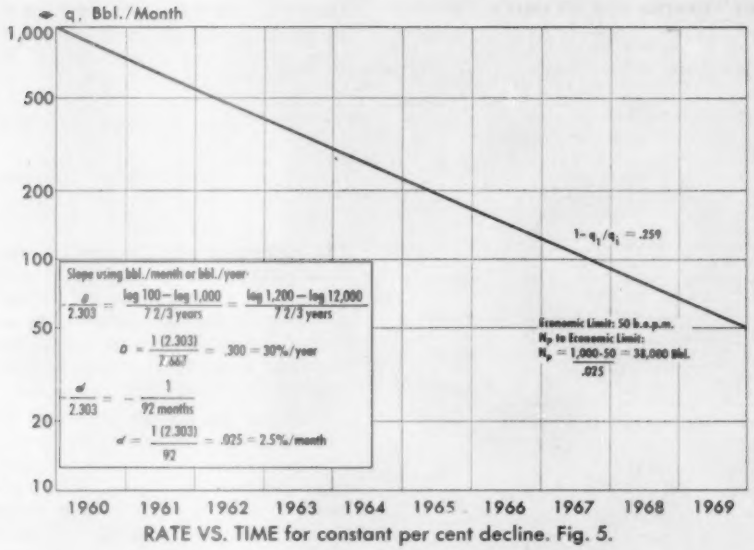
By using true decline, the decline constants for given time intervals vary by the time conversion factor, i.e.,



SEMILOG PLOT of q vs. T is more common approach, but also the source of error. True slope of this line is found by using equation 8. Fig. 3.



CUMULATIVE PRODUCTION vs. production rate on Cartesian paper yields a straight line with slope $-D$. Total recovery at some economic limit can be found directly from this plot. Fig. 4.



RATE VS. TIME for constant per cent decline. Fig. 5.

yearly decline is 12 times monthly decline or 365 times daily decline. Analysis of Equation 6 forces the same conclusion since, for a given N_p, the monthly or yearly rates—and hence the monthly or yearly declines—can vary only by a factor of 12. And, the factor of 12 between monthly and yearly decline holds regardless of what value the decline has. As will be shown, no such constant relationship exists between monthly and yearly loss ratios.

Equation 13 may be illustrated by the following example:

Given:

$q_1 = 12{,}000$ bbl. per year (1,000 bbl. per month)

$T = 1$ year

$D = 30\%$ per year

Then:

$q = q_1 e^{-DT} = 12{,}000\ e^{-0.3} = 12{,}000\ (0.74082) = 8{,}889.84$ bbl. per year (740.82 bbl. per month)

Or by taking an initial rate of 1,000 bbl. per month and declining it at 2.5% per month for 12 months yields a final rate of 740.82 bbl. per month.

This example is plotted as rate versus time in Fig. 5, and rate versus cumulative production in Fig. 6. Table 1 gives monthly rate and production figures for the first year. The accuracy with which the data in Table 1 have been calculated is not normally justified in practice, but is used here to demonstrate the relationships described in the body of the report.

Determination of Per Cent Decline From Production Data

Relationship between loss ratio and true decline. In practice, the data available are monthly and/or yearly production figures. A common approach is to use the yearly loss ratio—one minus the ratio of succeeding years' production—as yearly per cent decline. The amount by which this procedure varies from true decline will now be shown.

The ratio of succeeding years' production is equal to the ratio of the beginning production rate for the second year to that of the first year. To show this let:

R = ratio of succeeding years' production

q_1 = barrels per year at start of first year

q_1 = barrels per year at end of first year or start of second year

q_2 = barrels per year at end of second year

D = yearly decline, a fraction

The production by years is:

$$\text{First year's prod.} = \frac{q_1 - q_1}{D} \quad (14)$$

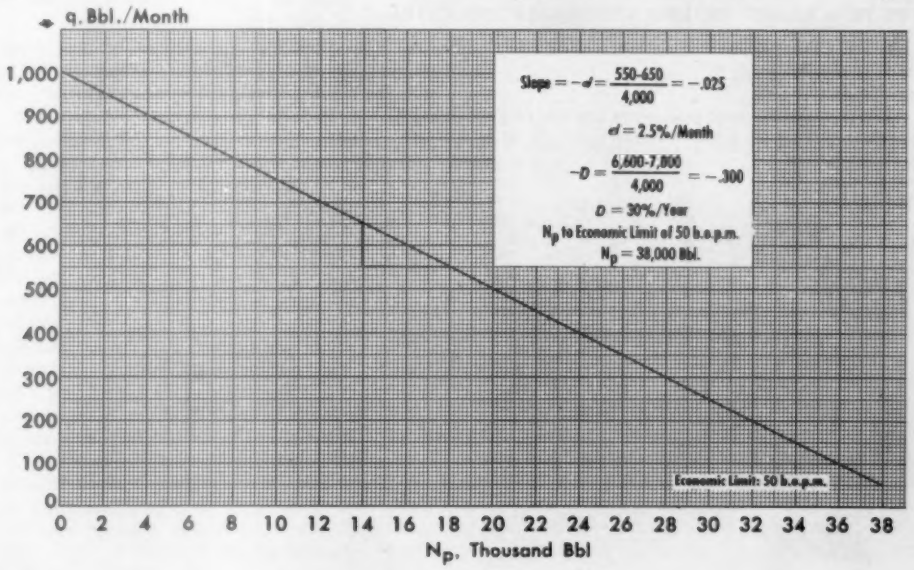
$$\text{Second year's prod.} = \frac{q_1 - q_2}{D} \quad (15)$$

Dividing Equation 15 by 14 gives:

$$R = \frac{q_1 - q_2}{q_1 - q_1} \quad (16)$$

But $q_1 = q_1 e^{-D(1)}$ and $q_2 = q_1 e^{-D(1)}$, so Equation 16 becomes:

$$R = \frac{q_1 - q_1 e^{-D}}{q_1 - q_1 e^{-D}} = \frac{q_1 (1 - e^{-D})}{q_1 (1 - e^{-D})} = \frac{q_1}{q_1} \quad (17)$$



RATE VS. cumulative production for constant per cent decline. This plot and the one in Fig. 5 are used in the example illustrating the use of Equation 13. Fig. 6.

TABLE 1—FIRST YEAR'S PRODUCTION BY MONTHS FOR EXAMPLE DECLINE

$q_1 = 1{,}000$ Bbl./Month or 12,000 Bbl./Year
$D = 2.5\%$/Month or 30%/Year

	q	Bbl./month	Δq	Month's prod. $= \Delta q/0.025$
	q_1	1,000.00		
January			24.69	987.60
	q_1	975.31		
February			24.09	963.60
	q_2	951.22		
March			23.49	939.60
	q_3	927.73		
April			22.90	916.00
	q_4	904.83		
May			22.34	893.60
	q_5	882.49		
June			21.79	871.60
	q_6	860.70		
July			21.25	850.00
	q_7	839.45		
August			20.73	829.20
	q_8	818.72		
September			20.21	808.40
	q_9	798.51		
October			19.72	788.80
	q_{10}	778.79		
November			19.22	768.80
	q_{11}	759.57		
December			18.75	750.00
				10,367.20
	q_{12}	740.82		

First year's production:

$$N_p = \frac{12{,}000 - 8889.84}{0.30} = \frac{3110.16}{0.30} = 10{,}367.2 \text{ bbl.}$$

$$N_p = \frac{1{,}000 - 740.82}{0.025} = \frac{259.18}{0.025} = 10{,}367.2 \text{ bbl.}$$

Second year's production:

$$q_8 = 8889.84\ (0.74082) = 6585.77 \text{ bbl./year}$$

$$N_p = \frac{8889.84 - 6585.77}{0.30} = \frac{2304.07}{0.30} = 7{,}680.02 \text{ bbl.}$$

Ratio of succeeding years' production $= R = 7{,}680.02/10{,}367.20 = 8889.84/12{,}000 = 740.82/1{,}000 = 0.74082$. $1 - R = 0.25918$
Ratio of succeeding months' production $= r = 975.31/1{,}000.00 = 0.97531$. $1 - r = 0.02469$

TABLE 2—COMPARISON OF TRUE YEARLY DECLINE AND YEARLY LOSS RATIO

$$R = \frac{q_t}{q_t} = e^{-D(1)}$$

True decline D	Yearly loss ratio $(1 - R)$	% Difference based on D	% Error in N_p by using $(1 - R)$ as D in Eq. (6)
0.01	0.00995	0.50%	0.50%
0.02	0.01980	1.00	1.01
0.03	0.02955	1.50	1.52
0.04	0.03921	1.98	2.02
0.05	0.04877	2.46	2.52
0.10	0.09516	4.84	5.09
0.15	0.13929	7.14	7.69
0.20	0.18127	9.37	10.33
0.25	0.22120	11.52	13.02
0.30	0.25918	13.61	15.75
0.35	0.29531	15.63	18.52
0.40	0.32968	17.58	21.33
0.45	0.36237	19.47	24.18
0.50	0.39347	21.31	27.08
0.55	0.42305	23.08	30.01
0.60	0.45119	24.80	32.98
0.75	0.52763	29.65	42.15
1.00	0.63212	36.79	58.20
1.25	0.71350	42.92	75.19
1.50	0.77587	48.28	93.33
1.75	0.82623	52.79	111.81
2.00	0.86466	56.77	131.30

Thus, one minus the ratio of succeeding years' production is equal to $1 - q_1/q_t$, or in terms of true decline, D:

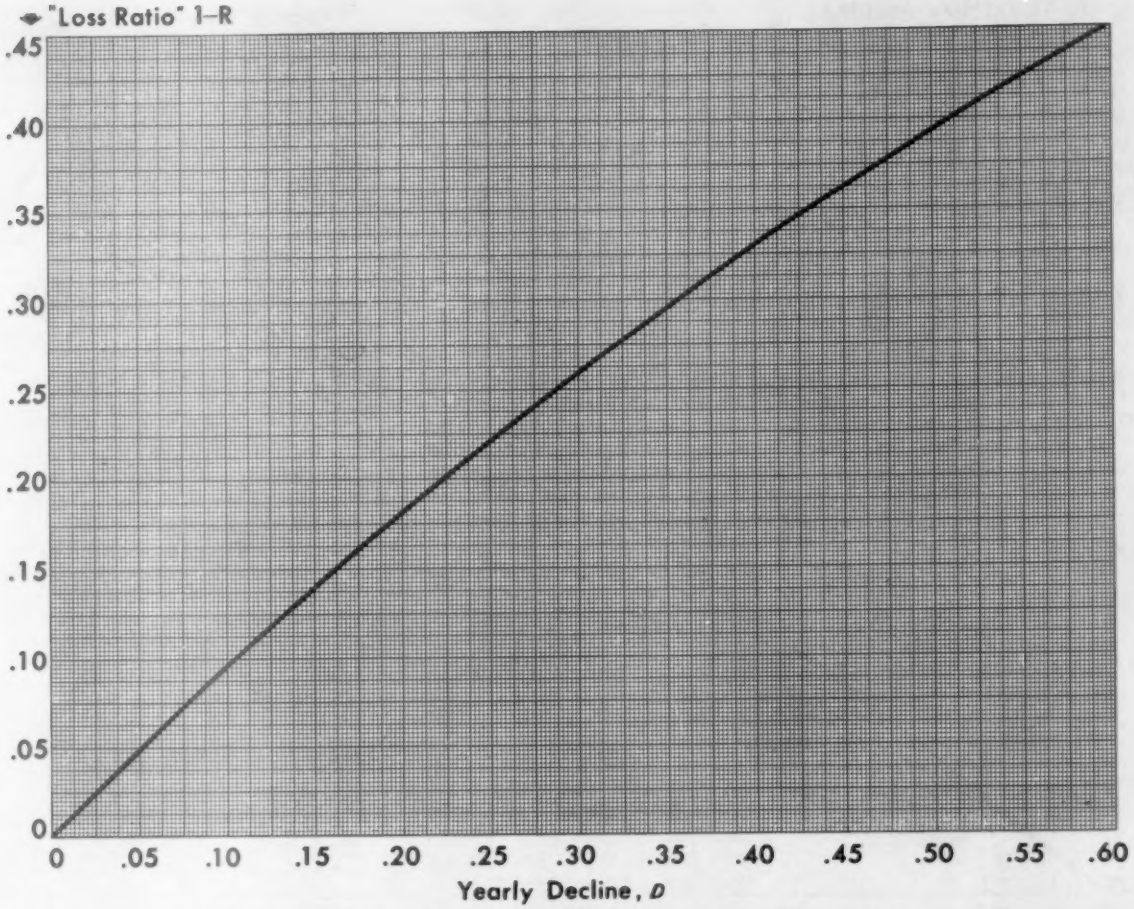
$$1 - R = 1 - e^{-D} \qquad (18)$$

$$R = e^{-D} \qquad (18a)$$

The significant point is that a constant ratio of succeeding years' production, R, is proof that a constant-per cent decline is operative. However, contrary to popular usage, the loss ratio is not the per cent decline, although it is directly related to it.

This may be further illustrated by looking at the decline curve shown in Fig. 5. From this, the value of the yearly loss ratio, $1 - q_1/q_t$, is approximately 0.259 (or 0.25918 from Table 1). It is obtained by starting at a point where the line crosses a q of 1,000 or 100, moving to the right an interval of 1 year, thence down to the curve. Note that the constant 0.25918 is neither the slope of the line nor the decline; the decline for the example curve is 0.30. The amount by which $1 - R$ varies from the true decline is a function of the slope (or decline) of the line. For this case, the variance is almost 14%. If the decline were 60% per year, the value of $1 - R$ would depart from it by almost 25%. While the difference between true yearly decline and yearly loss ratio increases with increasing decline, the error in the calculated value of cumulative production, N_p, increases much more rapidly with increasing decline. A comparison of true yearly decline and yearly loss ratio for various declines and the error in N_p caused by using $1 - R$ as D in Equation 6 are given in Table 2. Yearly decline is plotted versus $1 - R$ in Fig. 7.

The loss ratio could be, and often is determined on a monthly basis. Thus, monthly decline is used as $1 - r$, where r is the ratio of succeeding months' production. From Table 1, the monthly loss ratio for the example is 0.02469 while the true monthly decline is 0.025. This shows that the magnitude of error resulting from the use of loss ratio as decline is a function of (1) the true decline, and (2) the time interval under consideration. As the time interval involved decreases, the loss ratio approaches the true decline. But even if a certain time interval is used—1 year, for example—the difference between true decline and loss ratio increases as the decline increases. These points may be shown by calculating the cumulative production to an economic limit of 50 bbl. per month for the example decline curve:



TRUE DECLINE can be found from this curve if the loss is known. Fig. 7.

True Decline

$$N_p = \frac{12{,}000 - 600}{0.30} = 38{,}000 \text{ bbl.}$$

$$N_p = \frac{1{,}000 - 50}{0.025} = 38{,}000 \text{ bbl.}$$

Loss Ratio

$$N_p = \frac{12{,}000 - 600}{0.25918}$$

$$= 43{,}985 \text{ bbl. (15.75\% error)}$$

$$N_p = \frac{1{,}000 - 50}{0.02469}$$

$$= 38{,}477 \text{ bbl. (1.26\% error)}$$

Since the yearly loss ratio $= 1 - q_1/q_i = (q_i - q_1)/q_i$, it expresses the loss in rate for 1 year as a fraction of the beginning rate for that year. But it is not the true decline because the slope of the rate-time curve involves the difference in the logarithms of the rates. Actually, the use of loss ratio as decline amounts to a finite difference approximation to the definition of decline given by Equation 1. That is:

$$\text{Loss ratio} = \frac{\Delta q/\Delta T}{q} \cong \frac{dq/dT}{q} \quad (19)$$

If ΔT is 1 year and the reference rate is the rate at the beginning of the year, then:

$$\text{Yearly loss ratio} = \Delta q/q$$

$$= \frac{q_i - q_1}{q_i} = \frac{q_1 - q_2}{q_1}, \text{ etc.} \quad (20)$$

From a mathematical point of view, loss ratio and true decline are the same only at vanishingly small time intervals. In practice the use of monthly loss ratio as monthly decline will usually be close enough, but extension of this approach to a yearly basis will yield significant errors unless the yearly decline is rather small (5% or less). The error in N_p by using monthly or yearly loss ratios as monthly or yearly declines, respectively, may be written as:

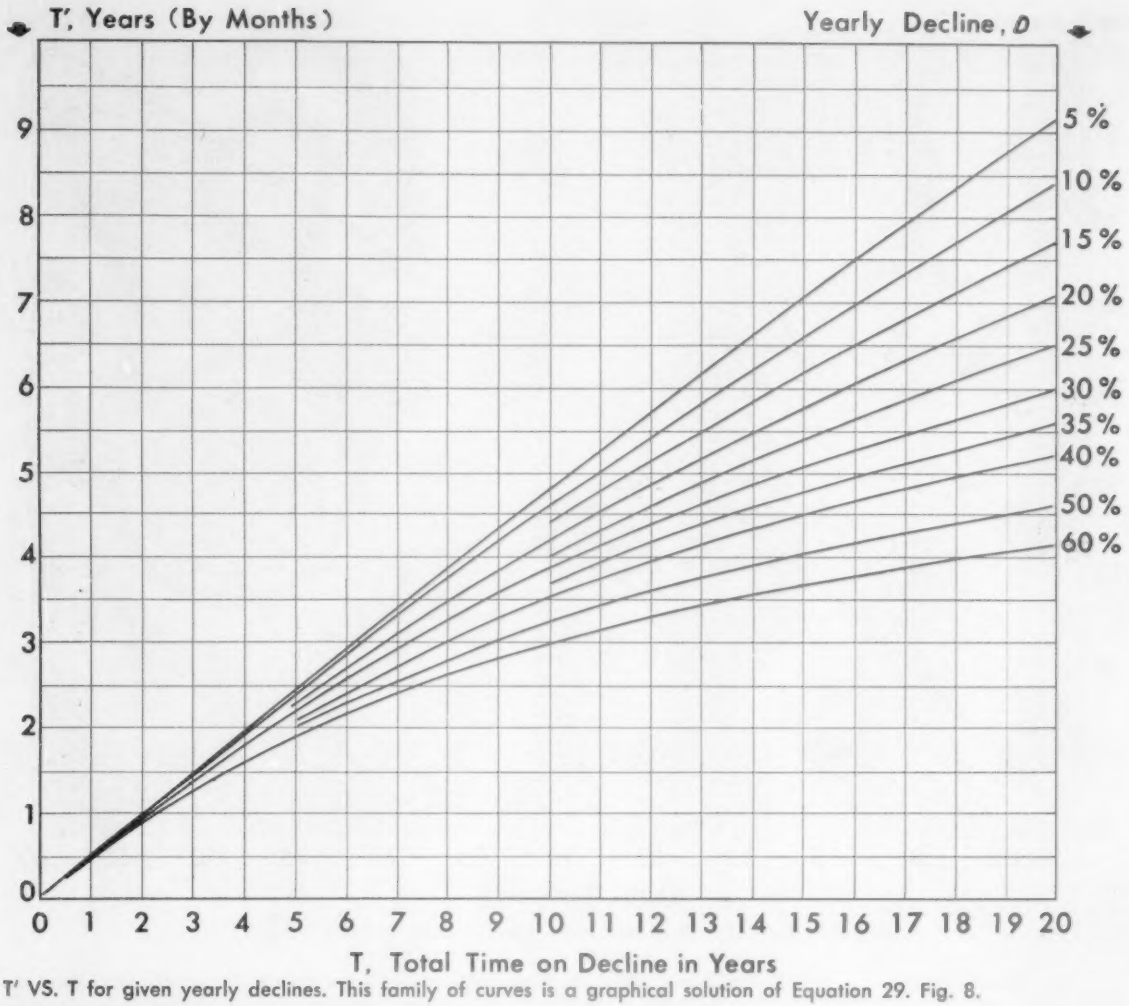
$$\text{Per cent error in } N_p = 100\,[d/(1 - r) - 1] \quad (21)$$

$$\text{Per cent error in } N_p = 100\,[D/(1 - R) - 1] \quad (22)$$

For example, the error using a rather high, but not uncommon, yearly loss ratio of 0.69881 (120% per year decline) is 74.21% while the corresponding monthly loss ratio of 0.09516 (10% per month decline) yields only 5.09% error in N_p.

From Equation 20, it is seen that loss ratio can be no greater than 100% because the reference rate is the rate at the beginning of the time interval. But true decline is a fraction of a constantly decreasing rate. The reference rate is the rate existing at any time, and, in fact, the true decline can be greater than 100%.

Previously, it was shown that monthly and yearly declines vary by a constant factor of 12 regardless of



T' VS. T for given yearly declines. This family of curves is a graphical solution of Equation 29. Fig. 8.

the value of the decline. However, such is not the case for loss ratios. From Equation 18 the yearly loss ratio is $1 - R = 1 - e^{-D}$. Similarly, the monthly loss ratio is $1 - r = 1 - e^{-d}$ where d is true monthly decline. Taking the ratio of these and expanding the exponentials into series form gives:

$$\frac{\text{Yearly loss ratio}}{\text{Monthly loss ratio}} = \frac{1 - R}{1 - r} = \frac{1 - e^{-D}}{1 - e^{-d}}$$

$$= \frac{1 - (1 - D + D^2/2 - D^3/6 + D^4/24 \ldots)}{1 - (1 - d + d^2/2 - d^3/6 + d^4/24 \ldots)} \quad (23)$$

Substituting $D/12$ for d and performing the long division to get the first few terms yields:

$$\frac{\text{Yearly loss ratio}}{\text{Monthly loss ratio}} = 12 - 5.500\,D + 1.757\,D^2 - 0.420\,D^3 \ldots \quad (24)$$

This ratio approaches 12 as the decline approaches zero. As the decline increases, the factor between monthly and yearly loss ratios decreases from 12, **such factor being different for each value of decline.**

A rule of thumb sometimes used is that monthly decline is approximately one-tenth of yearly decline. Actually, this rule involves loss ratios rather than declines, and what it really means is that the ratio of Equation 24 is approximately 10 for a substantial range of declines as illustrated by the following tabulation:

True decline, per cent		Loss ratio, per cent		Yearly loss ratio
Yearly	Monthly	Yearly	Monthly	Monthly loss ratio
12	1	11.308	0.995	11.3
36	3	30.232	2.955	10.2
60	5	45.119	4.877	9.3

The rule of thumb or tables converting yearly loss ratio to monthly loss ratio will yield acceptable accuracy only if the monthly values are used because such values are close to the true monthly declines. Yearly loss ratio and the monthly value are not equivalent as declines because substitution of each into Equation 6 with proper values of initial and final rates will yield different values for N_p.

Note that loss ratio definition of decline could also be gotten from Equation 4b:

$$q/q_i = e^{-DT}$$

Expanding e^{-D} in an infinite series with $T = 1$ year gives:

$$q_1/q_i = 1 - D + D^2/2 - D^3/6 + \ldots \quad (25)$$

Using only the first two terms on the right-hand side defines yearly decline as 1 − R. But unless the decline were small, the first two terms would not be accurate enough.

From tabulated production figures, true decline can be determined from the ratio of succeeding time periods' production using $R = e^{-D}$ and $r = e^{-d}$ or $1 - R$ from Fig. 7. The decline is found from a rate-time curve as in Fig. 5, or the indicated yearly loss ratio can be converted to yearly decline using Equation 18 or Fig. 7. Known initial and final rates allow use of Equation 6, if N_p is known, of Equations 4 to 4d if T is known.

Plotting Rate-Time Curve From Production Data

When only yearly production figures are available, the immediate problem is just where, during each year, should that year's production be plotted on the rate-time curve. For zero decline, the points should be plotted at midyear, but for other decline rates, the points should be plotted prior to midyear. Here's an example:

From Table 1, the first year's production for the example decline is 10,367.2 bbl. Although this is often expressed as barrels per year it is not a rate. But rather it is the cumulative production resulting from an initial rate of 12,000 bbl. per year declining to a value of 8,889.84 bbl. per year by the end of the first year. Then at some time during the year the instantaneous rate will be **numerically equal** to the barrels of production for that year. This time value may be found as follows:

$$\frac{q_i - q_1}{D} = q_i e^{-DT'} \qquad (26)$$

$$\frac{q_i - q_i e^{-D}}{D} = q_i e^{-DT'} \qquad (26a)$$

$$\frac{1 - e^{-D}}{D} = e^{-DT'} \qquad (27)$$

So it is evident that the time of interest, T', is independent of the rate and is a function of decline alone. Rearranging Equation 27 and solving for T' gives:

$$T' = (2.303/D) \times \log_{10} [D/(1 - e^{-D})] \qquad (28)$$

For a decline of 30% per year, T' = 0.4876 years or 5.85 months. Then 10,367.2 bbl. (or 10,367.2/12 = 864 bbl.), if plotted at 5.85 months **will lie on the rate-time curve** plotted as barrels per year or barrels per month, respectively.

Viewing this from the other direction, given a rate-time curve, the rate at T' for each year is equal to the barrels of production for that year. The application of this in adding up the area under a decline curve to obtain cumulative production to the economic limit is obvious.

For declines of 10 and 60% per year, the values of T' are 0.496 year (5.95 months) and 0.483 year (5.79 months), respectively. Thus, unless the decline is extremely high, the common method of using the rate at midyear as an average yearly rate is well within engineering accuracy.

Equations similar to 26 through 28 on a monthly basis show that monthly production plotted at midmonth will lie on the rate-time curve for all practical values of decline.

Quite often the cumulative production, or the remaining reserve is gotten by using the rate at the middle of the remaining life as the average rate for the remaining time period. However, even for moderate declines, the resulting underestimate is sizable unless the time period is short. Equation 28 is but a special case (where T = 1 year) of the following equation:

$$T' = (2.303/D) \times \log_{10} [DT/(1 - e^{-DT})] \qquad (29)$$

For a given decline, D, and total time period, T, Equation 29 indicates the specific time, T', at which a rate exists which, if considered constant during the total time period, would result in the same production as that from the declining rate over the same time period. In Fig. 8, T' is plotted versus T with yearly per cent decline as a parameter. For intermediate values of decline, T' can be interpolated from the plot or calculated directly from Equation 29.

To illustrate the use of Fig. 8, consider again the example decline for which D = 0.30 and, for an economic limit of 50 bbl. per month, T = 10 years. From Fig. 8, T' = 46 months. Then from Fig. 5, the rate at 46 months is approximately 317 bbl. per month. The total production for the 10-year period is:

$$317 \times 12 \times 10 = 38{,}040 \text{ bbl.}$$

Next, suppose after 5 years, it is desired to establish the rate which will give the last 5 years' production. Then T = 5 years and T' = 26.3 months. The rate at 5 years + 26.3 months from Fig. 5 is 115 bbl. per month. The last 5 years' production is:

$$115 \times 12 \times 5 = 6{,}900 \text{ bbl.}$$

which compares with 6,920 bbl. calculated from the cumulative production equation.

This analysis is based on data which show constant per cent decline. Usually the plotted data, particularly monthly production, will show some scattering. Which of the several methods of drawing a curve through the points should be used, or indeed, whether the data may fit another type of decline are questions beyond the scope of this paper.

Cumulative Production Using Loss Ratio

If loss ratio is used as decline in the cumulative production equation, $N_p = (q_i - q)/D$, the results could be in error. But cumulative production for a constant-per cent decline can be calculated directly from the loss ratio. By definition, each year's production is a constant ratio of that of the preceding year. Then a geometric progression for cumulative production can be written as:

$$N_{pn} = N_{p1} + N_{p1}R + N_{p1}R^2 + N_{p1}R^3 + \ldots N_{p1}R^{n-1} \qquad (30)$$

$$N_{pn} = N_{p1} \frac{(1 - R^n)}{(1 - R)} \qquad (31)$$

Where:

N_{pn} = cumulative production after n years
N_{p1} = first year's production
R = ratio of succeeding years' production

The term (1 − R) in Equation 31 is recognized as the yearly loss ratio. The cumulative production for 10 years to an economic limit of 50 bbl. per month for the example decline is:

$$N_p = \frac{10{,}367.2\ (1 - 0.74082^{10})}{(1 - 0.74082)} = \frac{10{,}367.2\ (1 - 0.04981)}{(0.25918)} = 38{,}007 \text{ bbl.}$$

Or using the ratio of succeeding months' production, r, the first month's production, and the monthly loss ratio, the first year's production is:

$$N_p = \frac{987.6\ (1 - 0.97531^{12})}{(1 - 0.97531)} = \frac{987.6\ (1 - 0.74082)}{(0.02469)} = 10{,}367.2 \text{ bbl.}$$

Apart from the relationship between production rates and R already shown, it seems worth while to emphasize that Equation 30 or 31 involves pro-

duction during the first unit of time as distinct from production rate.

Conclusions and Recommendations

It is understandable that the use of loss ratio as decline has persisted. It seems, at first glance, both natural and convenient to say that if a well or lease suffers a 25% loss in rate each year, the decline is 25% per year. If, in computing the slope of the rate-time curve, the engineer erroneously uses the difference in rates rather than the difference in the logarithms of the rates, the loss ratio is obtained. Also, in many cases, while the yearly loss ratio is stated as the decline, the cumulative production is actually obtained graphically by adding up the area under the rate-time curve, which process involves true decline. Indeed, in such cases where the loss ratio (and the decline) is high, it is only because of the graphical approach that a reasonable value of cumulative production is obtained. Insertion of the loss ratio into the cumulative production equation would yield results hopelessly in error.

It is the author's conclusion that whether to use loss ratio or true decline is not just an arbitrary matter. The true decline definition is unique, being affected neither by the magnitude of the decline nor the time interval involved, and such definition is the mathematical basis for the standard rate-time and rate-cumulative production plots. As a further consequence of the true decline definition, monthly and yearly declines are shown to vary by a factor of 12 regardless of the value of the decline.

Correct answers come only from the use of correct data. The evaluation engineer should be sure that he is using true decline where required in the equations presented here. By following the definitions of true decline and loss ratio, all extrapolations will be on the same basis, bringing an end to confusion.

Acknowledgment

The author expresses appreciation to the management of Sohio Petroleum Co. for permission to publish this paper.

(Note: The author has prepared a nomograph for the rate-time equation using true yearly and monthly declines. This nomograph will be published in the near future along with an example of how to plot a rate-time curve and rate-cumulative production curve beginning with tabulated yearly production.)

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2. Pirson, S. J., "Production Decline Curves of Oil Well May Be Extrapolated by Loss Ratio": The Oil and Gas Journal (1935), Nov. 14, p. 34.
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RESERVOIR Engineering

26. How to find interstitial-water saturation from analysis of oil-base-mud cores

BY E. T. GUERRERO
and
F. M. STEWART

GIVEN: The pay sand in a development well was cored with oil-base mud. Samples from the core were analyzed for water content, using a retort-type[1] apparatus. The following data pertain to one of the samples:

Volume of water extracted = V_w = 1.11 cc.

Pore volume of core = PV = 4.10 cc.

Sand thickness represented by sample = 1 ft.

FIND: Reservoir water and initial oil saturations at the well and in the interval of sand represented.

METHOD OF SOLUTION: The observed data are used with the following equations to find the needed saturations:

$$S_w = V_w/PV \quad (1)$$

$$S_{oi} = 1 - S_w \quad (2)$$

Where:

V_w and PV are defined with the data and

S_w = water saturation at reservoir conditions, fraction

S_{oi} = initial oil saturation at reservoir conditions, fraction

SOLUTION:

$$S_w = 1.11/4.10 = 0.271 \text{ or } 27.1\%$$

$$S_o = 1 - 0.271 = 0.729 \text{ or } 72.9\%$$

DISCUSSION: This problem illustrates what is considered to be the best method for finding interstitial-water saturation. The assumption is made that none of the interstitial water is flushed by the coring process using oil-base mud. The invading oil filtrate will merely displace formation oil. Furthermore, while the core is removed from the well, it is assumed that the evolvement of solution gas does not cause a change in water saturation. These assumptions should be valid for any core in which the water content is equal to or less than the minimum interstitial value. It will be recalled that the minimum interstitial is the maximum water saturation that a porous media can contain and still virtually have zero effective permeability to water. In cases where the water saturation is much higher than the minimum interstitial, the oil filterate may flush water and thus make the results misleading.

Although considered reliable, this method of interstitial-water-saturation determination is not used very much. Because of high cost, oil-base muds are not frequently used. It is not even considered economical to convert to oil-base mud for coring and well completion except in special cases to prevent the caving of certain shales and to drill into formations susceptible to damage by water.[2] The method is recommended, however, on special occasions where it is desired to check the applicability of the capillary or electric-log approaches.

At discovery, the oil column of a pool generally contains two fluids, oil and water. Thus if the fraction of either can be obtained, the saturation of the other can easily be computed with a relationship such as given by Equation 2.

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Product-pipeline terminal is remotely controlled

• Turbine meter is used for local measurement, flow control, and remote telemetering of flow rate. Terminal makes heart-cut deliveries from 30,000-100,000-bbl. batches. Success of installation is basis for construction of second unattended terminal.

BY D. T. DURRANT
Chief dispatcher, Sarnia Products Line,
Imperial Oil Ltd.

A NEW unattended pipeline delivery terminal is operating on Imperial Oil Ltd.'s Sarnia Products Pipeline.

As shown in Fig. 1, this pipeline is an 188.5-mile system between Sarnia and Toronto with two 6.7-mile spur-line takeoffs from Waterdown, serving the Hamilton area. The system at present has three main-line pumping stations and seven delivery terminals.

The new St. George plant is a marketing terminal of Imperial Oil Ltd. and is located adjacent to the Sarnia Products Pipe Line at a point 20 miles west of the pipeline's central dispatch and control office located at Waterdown, Ont. Products are supplied from the pipeline to the marketing-plant tankage through a remotely controlled pipeline terminal which is operated from the Waterdown dispatch office.

Because some local assistance was available from the marketing-terminal staff, it was not necessary to extend meter ticket printout and tank-manifold control facilities to Waterdown. Supervisory control was, therefore, limited to that which could be economically justified at this time. Accordingly, between deliveries from the pipeline, marketing-plant personnel reset certain local equipment, insert new meter delivery tickets, and set tank lines in preparation for the next delivery which may then take place at any time during the day or night without any attendance.

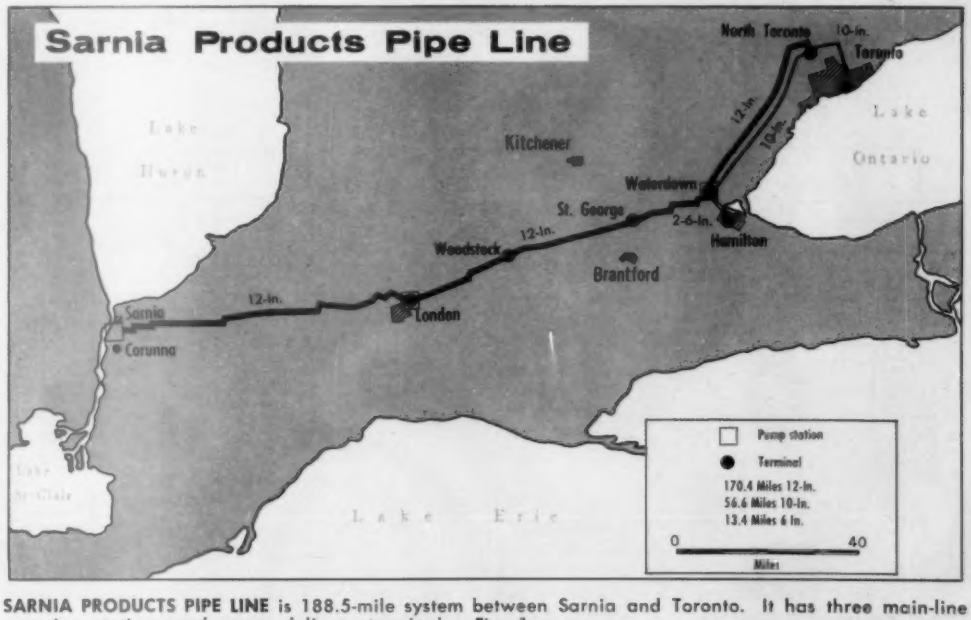
The latest techniques in pipeline measurement and control were used in the design of the terminal to minimize investment and operating costs and still meet all operational requirements. A simple, flexible design was necessary to avoid need for attendance during deliveries and to enable frequent deliveries to be made from product batches at any time they were passing this location.

Cooperation with the shipper (in this case the marketing department of Imperial Oil) during the initial design phase permitted selection of tankage for most efficient utilization. This factor alone contributed greatly to the economic feasibility of the project.

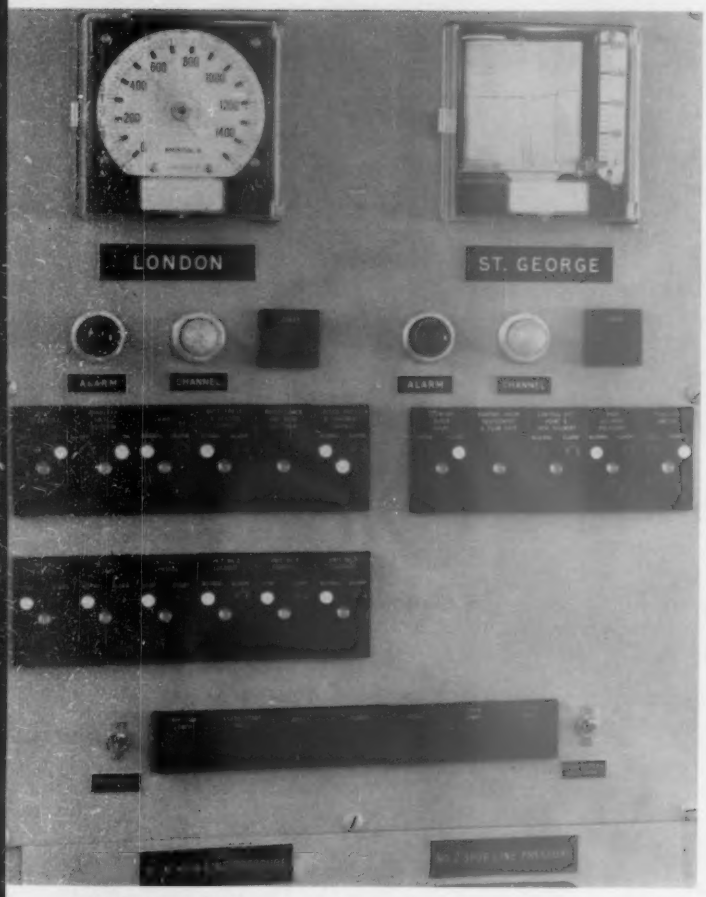
Design and Equipment

In line with the above considerations, a turbine-type meter with an electrical output was selected as an alternative to positive-displacement meters, as it could be used for both local measurement and flow control, and remote telemetering of flow rate. This type of meter provides a very accurate flow-rate signal which is telemetered to Waterdown and also provides a signal for automatic control of the delivery rate and printout of total quantities.

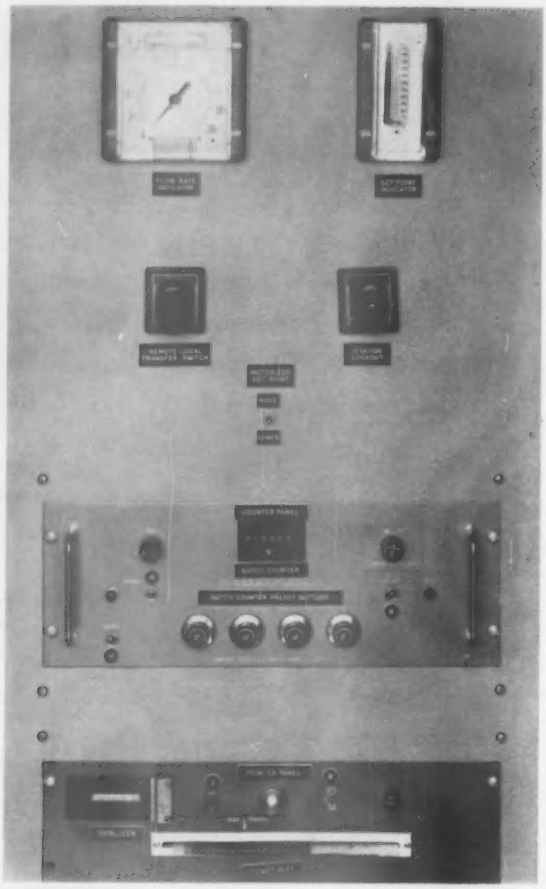
Figs. 2 and 3 represent the two panels used in operations, one being at St. George terminal and the other mounted in the dispatch control center. A schematic diagram of the control functions is shown in Fig. 4. Two a.c. signals are picked up from the turbine meter. As indicated, one signal



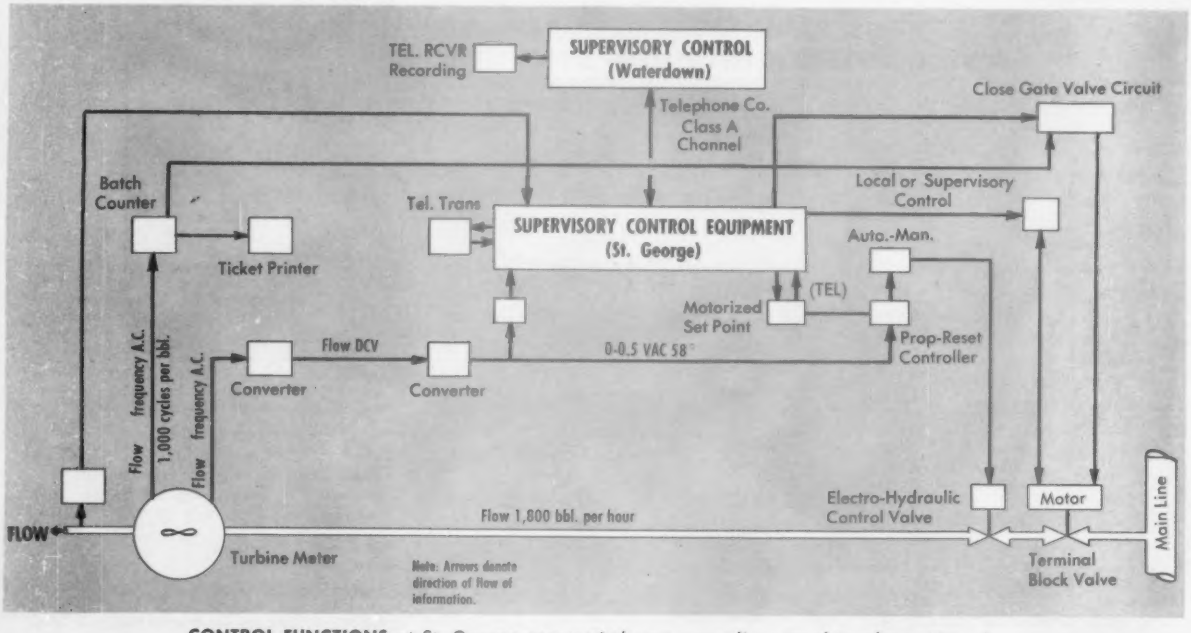
SARNIA PRODUCTS PIPE LINE is 188.5-mile system between Sarnia and Toronto. It has three main-line pumping stations and seven delivery terminals. Fig. 1.



CONTROL CONSOLE at Waterdown station is used to operate the St. George terminal. Fig. 2.



LOCAL PANEL at St. George terminal is used occasionally by marketing personnel. Fig. 3.



CONTROL FUNCTIONS at St. George are carried out according to this plan. Fig. 4.

ST. GEORGE, showing main line, gate valve, control valves, meter, and tank manifold. Fig. 5.

is fed to the batch counter, a ticket printer, and an overdelivery alarm.

The other signal, through the devices shown, is converted to direct current. It is fed both to supervisory-control equipment for selective telemetering of flow rate and through a proportional reset controller to position the electrohydraulic operator on the control valve. Supervisory control is by means of a pulse-code check-back system operating over a Class A telegraph channel. Telemetering is of the pulse-duration type, carried on a selective basis over the same channel as the supervisory-control pulses.

Operation

From the Waterdown control center, the dispatcher may:

. . . Open and close the motor operated terminal-delivery block valve.

. . . Incrementally raise or lower the terminal-delivery flow-controller set point. The terminal is brought on stream by starting with a zero set point and gradually raising it to the desired final flow-rate setting.

. . . By observing the flow-rate recorder and adjusting the set point, cause the terminal control loop to maintain the required flow rate.

. . . By observing the visual alarm lamps, determine if there has been a channel failure, a temporary shutdown, or a terminal lockout.

Both high delivery pressure and a batch overdelivery are indicated visually by lamps, and both of these functions automatically shut down the delivery. A channel failure is indicated by lamp and an alarm, but leaves the terminal in its existing position. The panel shown in Fig. 2 marked "St. George" is set up by the marketing-plant personnel at the terminal. This need only be done between deliveries.

At this time, the personnel are concerned only with the setting of the batch counter for the overdelivery safety function, punching and changing the ticket, and other checks on the panel. For maintenance purposes or during a channel failure, the terminal can be operated locally using the controls as shown on this panel. This, in turn, is indicated on the dispatch panel as a local delivery by visual lamp.

The following will illustrate a typical delivery procedure:

1. Marketing-plant attendant presets tank lines, resets overdelivery batch counter, and checks that a fresh meter ticket is in place and stamped for start of delivery well in advance of the delivery. He then advises the dispatcher at Waterdown that the predelivery procedure is complete.

2. At the scheduled time for the delivery the dispatcher opens the terminal-delivery gate valve by selecting this point on the supervisory control, then pressing the "open" button on his console escutcheon. Lamps on this escutcheon indicate the position of the valve.

3. The dispatcher then selects "set point control" and can incrementally raise the flow-controller set point until the desired delivery rate is indicated on the recording telemeter receiver. He can also check the set-point setting by selecting "set point position." This variable will then be indicated on the telemeter receiver.

4. The delivery will then be made with automatic control of flow rate at the desired value.

5. When the delivery is complete as calculated on a rate-time basis, the dispatcher again selects the terminal-delivery valve point on his supervisory-control console and then operates the "close" push button. The terminal can also be shut down by first incrementally reducing the flow controller set point to zero, then closing the terminal-delivery gate valve.

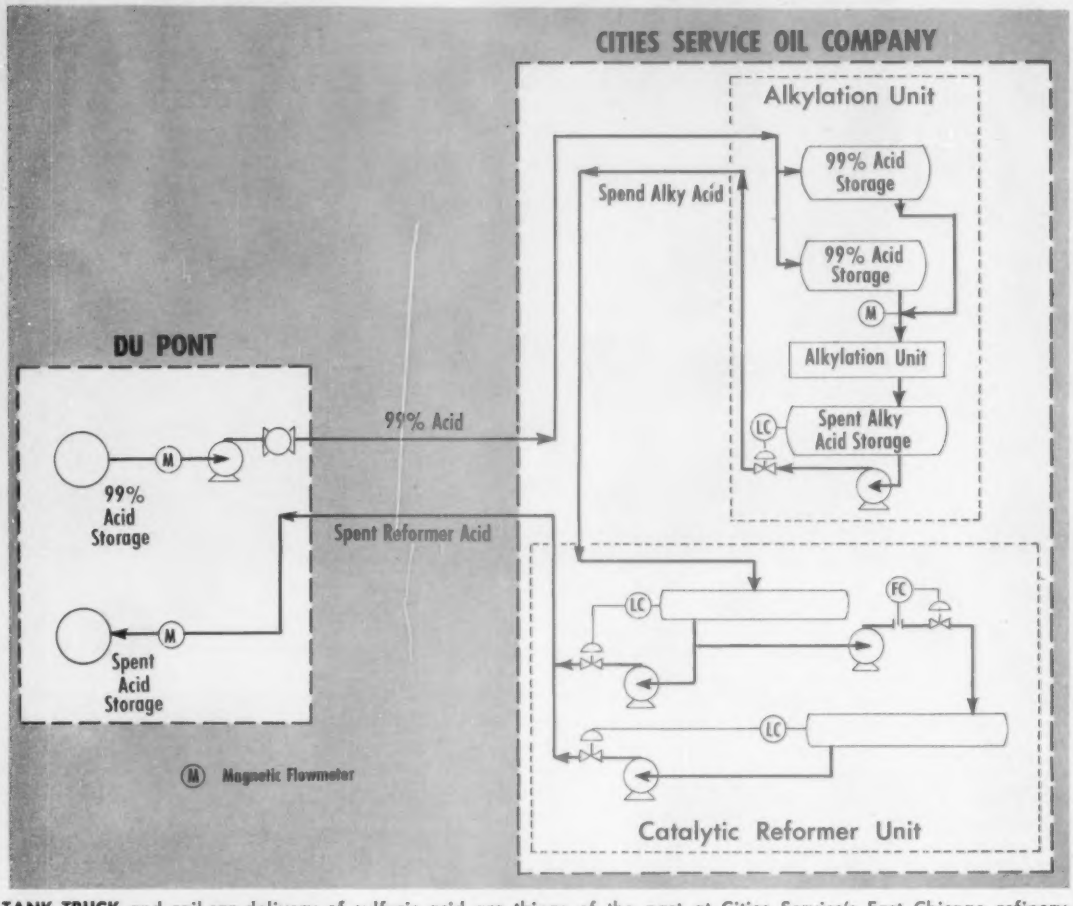
6. Should the dispatcher be in error on his rate-time calculation of the size of the batch delivered, the terminal gate valve will automatically close when the overdelivery batch counter reaches a preset number of barrels. This counter is preset by the marketing-plant attendant for a nominal amount larger than the scheduled batch size and its main function is to prevent tank runover.

7. The marketing-plant personnel can then punch and remove the meter ticket and close off the tank lines at any convenient time after the delivery is complete.

Performance

With the exception of initial calibration, and the usual test-period "bugs," the terminal has proved relatively free of maintenance difficulties. The turbine meter was tested during the initial startup period in series with a meter of the positive-displacement type. Its performance proved most satisfactory and it is now considered completely operational.

Based on the experience gained on this installation and employing similar design principles, a second remote-controlled delivery terminal has been engineered and is now being constructed on the Sarnia Products Pipe Line at Toronto.



TANK TRUCK and rail-car delivery of sulfuric acid are things of the past at Cities Service's East Chicago refinery. The company's money-saving . . .

Pipeline delivers sulfuric acid

BY KENDRICK D. FETROW
Project Engineer
Cities Service Refinery,
East Chicago, Ind.

PIPELINE DELIVERY of sulfuric acid to its alky unit is paying off for the East Chicago, Ind., refinery of Cities Service Oil Co. (Del.). By replacing tank truck delivery, the system has cut maintenance and transportation costs considerably.

Of course the refinery has a few natural advantages. E. I. du Pont de Nemours & Co.'s Grasselli chemical plant is only a mile away, and one of its products is sulfuric acid. Since it went into service in January, the pipeline has operated trouble-free.

The 99% acid is delivered continuously from Du Pont storage to the alkylation plant. Vessels previously used for sulfuric acid storage at Cities Service are now used as surge drums to provide an "in operation" check of the flowmeter.

Before it's returned to Du Pont for regeneration, the spent acid is charged to a surge drum at the catalytic reformer. A major portion of it is used here to desulfurize reformer feed stock.

Acid precipitated from the desulfurizing unit plus excess alkylation acid are returned to Du Pont's spent acid storage. It's then regenerated to complete the cycle. Fig. 1 is a schematic flow diagram of the system.

Design and construction. Aboveground piping is Schedule 80 carbon steel. The underground portion of this line is ductile-iron pipe cased in a steel sleeve. Piping was designed for viscous flow to combat the excessive corrosion caused by turbulence.

Temperature must be held within the following limits:

- Freezing temperature of 99% sulfuric acid (60° F.)
- Temperature at which spent acid severely attacks carbon steel (140° F.)

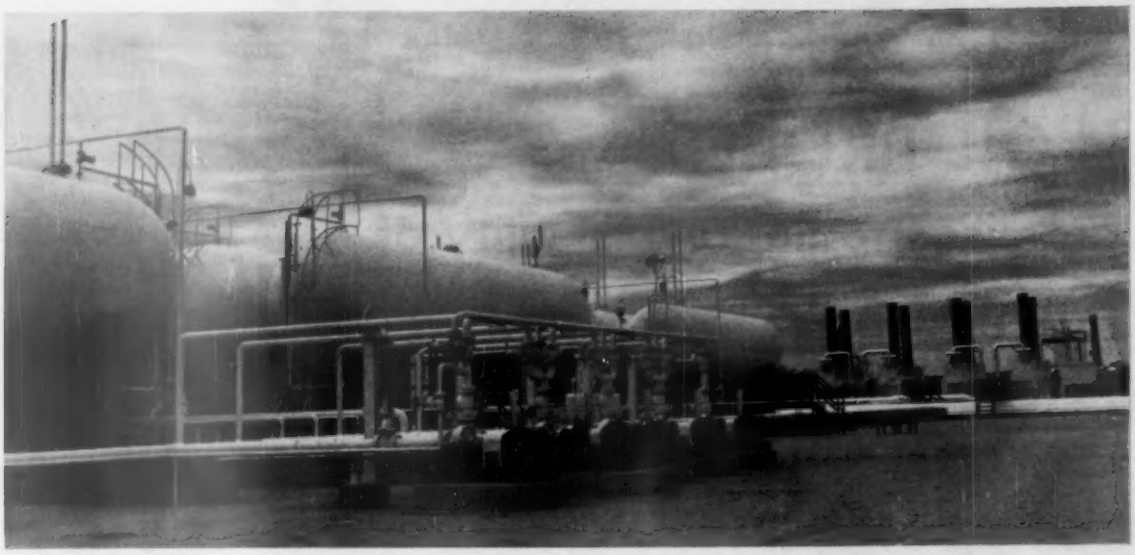
Du Pont's section of the line is electrically heated with automatic controls actuated by thermocouple probes at various points along the line.

Cities Service's portion is steam-traced with thermostatically controlled regulators. The regulators maintain a constant temperature in the air void between the exterior insulation and the thin layer of insulation surrounding each pipe.

This thin layer of insulation eliminates the corrosion caused by overheating points of contact between the steam tracer and acid lines.

Flow rates of the acid streams are metered by magnetic flowmeters. Temperature recorders and sampling provide the remaining information required for accounting purposes.

Statistical analysis shows that there is a 95% assurance that aggregate monthly strength of the acid will not vary more than plus or minus 0.5%.



THIS WARREN-OPERATED PLANT was designed to initially strip 100 M.M.c.f.d. of natural gas from large gas field in Wise and Jack counties, Texas. It has pressure storage for all four liquid products.

Gas-processing plant features

- **Direct thermal stripping**
- **Absorption-oil presaturator**
- **Hydraulic recovery unit**
- **Fractionating lean-oil still**

A NEW $3,000,000 gas-processing plant near Bridgeport, Tex., is owned by Christie, Mitchell & Mitchell, a Houston oil and gas company, but it will be operated by Warren Petroleum Corp. The plant was designed for an initial capacity of 100 M.M.c.f.d. of natural gas with allowances for later expansion to 150 M.M.c.f.d. Liquid production is expected to be more than 177,000 gal. daily.

Some of the relatively new features included in the plant design are direct thermal stripping, an absorption-oil presaturator unit, a fractionating-type lean-oil still, and a hydraulic-power recovery unit that uses pressure let-down of the rich oil stream from the absorbers to the flash tank.

Absorption. Gas flows through the plant absorbers at transmission pipeline pressure of 675 to 775 psig. Two parallel absorbers were used to limit the required thickness of the vessel shell steel. Absorption oil picks up the liquid product, about 8% of the total volume, and the remaining dry gas flows on to the pipeline.

Hydraulic turbine. Rich oil is dropped to a pressure of 250 psig. between the absorbers and a cold flash tank to unload ethane and methane. To make use of this necessary pressure drop, the high-pressure rich oil is passed through an Ingersoll-Rand hydraulic turbine which drives a low-pressure lean-oil pump at 3,560 r.p.m. The turbine recovers 200 hp. of "free power" that otherwise would have been dissipated in a pressure-reducing valve.

The stabilizing facilities are designed to deethanize the rich oil to such a degree that specification commercial propane will be produced as an overhead product from the depropanizer. Ethane and methane in excess of fuel requirements are recompressed by gas engine-compressors to 700 psig. and dispatched to the outgoing pipeline. The original installation included two units, each incorporating a 330-hp. gas engine driving three integrated horizontal compressor cylinders. In short order, a third unit was added to increase compressor capacity 50%.

Oil stripping. Plant design is based upon stripping liquid products from the absorption oil by a direct thermal distillation process. To achieve temperatures in the order of 550° to 575° F., rich oil from the stabilizers is pumped through four parallel direct-fired horizontal-tube heating furnaces which provide the plant's total heat requirements.

This method of oil stripping is relatively new in the natural-gasoline industry and is used in lieu of two other common stripping methods—thermal distillation aided by steam injection and distillation aided by light-hydrocarbon injection. Elimination of steam dispenses with the boilers, cuts corrosion, and results in a cleaner absorption oil. Further, the new method provides high circulation off the base of the still without agitation.

Fractionation. The product fractionation facilities include a depropanizer, debutanizer, and a deisobutanizer to reduce propane, isobutane, normal butane, and natural gasoline. Reboiler and preheater units provide a means for transferring heat to specific process streams from the hot lean-oil stream leaving the base of the still. The lean oil is pumped from the still through the heat exchange units to a presaturator unit by a trio of pumps driven by a 200-hp. motor, a 125-hp. motor and the hydraulic turbine. The oil is presaturated with propane recovered from the deethanizer and then, completing the cycle, is delivered to the two absorbers at high pressure by a pair of eight-stage diffusor-type pumps driven by 400-hp. natural-gas engines.

Electric power. The 33 I-R motor-driven pumps add to a connected load of 1,216 hp. To supply this and other electrical requirements, the original plant was provided with three 540-hp. natural-gas engines, each driving a 380-kw. generator. These facilities were soon augmented by a fourth engine-generator set.

Storage. Pressure storage is provided for the four liquid products of the plant and tank-car and tank-truck loading facilities are located immediately adjacent to the plant proper.

H-OIL PROCESS
promises to improve quality of
DISTILLATE FEED

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THE RELATIVELY weak market for petroleum products over recent years has promoted severe quality competition. Whereas previously, hydrogen treating of furnace oil was sufficient to assure a refiner of a competitive position, recently it has become evident that some treating facilities are inadequate in this respect.

Difficulties with respect to nitrogen content, color, and gum stability have been experienced even when all of the components of the furnace oil pool have been treated; these difficulties usually occur in refineries processing sour crudes from the Middle East, California, or Venezuela, and particularly in those with coking facilities.

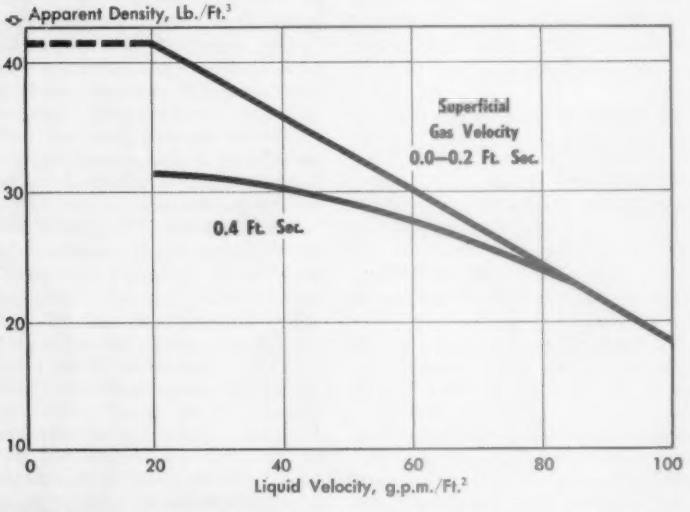
Although hydrogen-treating operations are relatively simple, the conventional fixed bed-downflow system has disadvantages.[1] This report describes a new process which is designated as the H-Oil process, summarizes its disadvantages, and provides results on typical distillate charge stocks.

Process Essentials

In the H-Oil process, a mixture of oil and hydrogen is fed upflow into an **ebullating bed of catalyst.** In this bed the catalyst is expanded in excess of its settled volume and is in a state of motion induced by the velocity of the oil and hydrogen. Unlike slurry systems, the catalyst is completely retained within the volume of the reactor so that it is unnecessary to provide means for its separation from the product oil.

The motion of the catalyst, together with the high velocity of oil, results in good contact between oil, hydrogen, and catalyst; it is evident that lateral distribution of reactants is readily effected. Catalyst attrition is insignificant, since the particles in motion in the ebullating bed are cushioned by an envelope of oil.

Fig. 1 is an example of the expansion of an ebullating bed of a typical catalyst as a function of liquid and gas velocity. The top of an ebullating bed is sharply demarcated from the nonsolid containing phase above it; unlike the analogous gas-solid fluidized bed, surging phenomena due to slugging and "ratholing" are completely avoided.



EBULLATING BED expansion is a function of liquid and gas velocity. Fig. 1.

Catalyst handling. An important advantage of the ebullating bed is that it allows catalyst to be added and withdrawn from the reactor system semicontinuously. Thus there is no down time as in fixed-bed systems when the whole bed of catalyst must be removed at the end of its operating life. Since the density of the catalyst increases with time on stream, semicontinuous removal of catalyst from the reactor bottom permits discarding of catalyst significantly less active than the average material.

A further advantage of the ebullating bed is its relative freedom from pressure-drop difficulties. In conventional fixed-bed downflow systems, such difficulties limit reactor resign, making it necessary to utilize a geometry which may not be the most economic. In addition, the reactor geometry which is demanded results in a low mass velocity of reactants so that diffusion-controlling reactions are not carried out at the highest efficiency.

In the conventional fixed-bed treating system, accumulation of scale on the top of the catalyst bed has resulted in turning around units which were still operating effectively with respect to catalyst activity. Such difficulties have resulted in considerable "hardware" at the inlet of such conventional fixed-bed systems including pipe distributors, baskets, distributing trays, chimneys, etc. By its very nature, the ebullating bed avoids such difficulties.

The absence of pressure-drop limitations in the ebullating bed makes it possible to use catalysts of relatively small particle size. The catalyst prevalently used has a diameter of only about 1/32 in. It has long been known that reduction in particle size increases the activity of hydrotreating catalysts.[2]

Operation at 1,500 psig. Commercial H-Oil plants treating furnace oil are preferably designed at a total pressure of 1,500 psig. Although the process can be profitably used at lower and more conventional process pressures, the benefits of 1,500-psig. operation are outstanding.

Due to much higher oil throughputs which are obtained at 1,500 psig. capital costs are essentially unchanged over lower-pressure operation. Nitrogen removal is improved at a given level of desulfurization. Catalyst inventory is only 10-20% of that in conventional systems. Importantly, the

Advantages claimed for the H-Oil process

1. The ebullating bed provides excellent contact between reactants and catalyst and permits the use of catalyst of relatively small particle size having a high activity. Thus reactors are smaller and the charged quantity of catalyst much less than in conventional fixed-bed units.

2. The ebullating bed allows freedom and economy in reactor design with respect to height-diameter relations.

3. The ebullating bed is free from pressure-drop problems of fixed-bed systems caused by scaling and corrosion. Hardware to mitigate such difficulties is not required.

4. The ebullating bed allows "continuous" replacement of catalyst and avoids unit down time for replacement as required in fixed-bed units.

5. Such continuous replacement of catalyst allows the refiner to market furnace oil of constant quality, avoiding quality swings as obtained in fixed-bed operation depending on whether the catalyst is relatively fresh or spent.

6. To produce furnace oil of a given maximum sulfur content (or any other limiting specification), continuous replacement of catalyst results in the use of only 30-50% as much net catalyst makeup as in a fixed bed at the same operating pressure.

7. Localized catalyst overheating cannot occur in the ebullating bed. Such local overheating is possible in a downshot fixed bed with poor liquid distribution.

8. On stocks where heat evolution would be high, the use of internal liquid recycle in the H-Oil process is less costly than expedients which must be used in fixed-bed processes without recycle.

9. Operating at 1,500 psig., the furnace-oil unit is flexible with respect to block operation with feeds in the catalytic feed and heavier boiling ranges.

10. Operating at 1,500 psig., the quantity of catalyst in the H-Oil reactor is only 10-20% of that in fixed-bed units at conventionally used pressures so that liability due to mishaps or errors (failure of hydrogen compressor, etc.) is much less than in fixed-bed units.

11. Operating at 1,500 psig., catalyst makeup rates are such that regeneration facilities are unnecessary. Down time for in situ regeneration is avoided.

12. Operating at 1,500 psig., nitrogen removal will be greater for a given extent of desulfurization than at 750 psig. Stability will be more satisfactory at the higher operating pressure.

13. Designed at 1,500 psig., the H-Oil plant anticipates more stringent product-quality requirements in the future.

furnace oil unit designed at 1,500 psig. has considerable flexibility with respect to substitution of heavier feeds, and anticipates the more stringent requirements of tomorrow with respect to furnace oil quality.

Internal liquid recycle. Internal liquid recycle is an important feature of the H-Oil process when charging residuums.[3] On such heavy stocks heat release is high as a result of hydrogen consumptions in the range of 500-1,500 s.c.f. per bbl. On most distillate feeds such recycle is not required. However, on some distillates of high sulfur and unsaturated content, heat release may be sufficiently high to necessitate internal liquid recycle. If so, this feature may be added at little extra cost.

In such a recycle system, reactor liquid effluent at reactor outlet conditions is simply pumped back to the inlet and again passed through the reactor. This internal recycle creates a sink into which heat produced in the process may be dissipated. The amount of recycle used depends on the charge stock and the amount of heat released. The cost of such internal recycle is small because of the very low-pressure head required.

Internal liquid recycle complements the ebullating bed in assuring excellent temperature control and distribution throughout the reactor. Devices such as spaced injection of feed, intermeTABLE 1—H-OIL PROCESSING OF LIGHT GAS OIL FEEDS

	Charge refinery No. 2	Product	Charge refinery No. 2	Product	Charge coker distillate	Product
HRI Number	1049	84-55-19	1050	84-55-24	1027	84-54-15
Gravity, °API	33.0	36.3	31.5	35.0	34.2	39.1
Distillation, °F.						
I.b.p.	326	310	344	320	350	284
10	426	414	434	414	398	374
50	499	494	513	497	484	462
90	573	573	586	582	588	575
F.b.p.	620	626	633	640	620	612
Sulfur, wt. %	0.91	0.010	1.36	0.022	1.57	0.022
Bromine No., cg./g.	16	6	25	9	45	8
Aniline pt., °F.	138	141	124	131	119	136
Nitrogen, p.p.m.	280	44	380	67	570	120
Color, ASTM	4	1.5	4	2	5	1.5
Color after aging*	6	2	8	2.5	8	2
Sediment after aging*, mg./l	35	5	54	5	66	10
Pour pt., °F.	−10	−10	0	0	−20	−10
Viscosity at 100° F., S.U.s.	36	35	36	38	36	34
Ramsbottom carbon on 10% bottoms, wt.%	0.4	0.2	0.6	0.2	0.3	0.2

TABLE 2—H-OIL PROCESSING OF HEAVY GAS OIL FEEDS

	Charge Catalytic feed	Product	Charge Coker distillate	Product
HRI No.	942	71-71-25	1030	72-71-28
Gravity, °API	24.1	28.7	18.7	24.6
Distillation, °F.				
I.b.p.	510	288	366	286
10	637	600	628	534
V% to 600° F.	5	10	10	20
Sulfur, wt. %	2.22	0.34	2.74	0.37
Aniline pt., °F.	183	190	134	144
Bromine no., cg./g.	14	7	30	14
Ramsbottom carbon, wt. %	0.3	0.2	0.3	0.3
Nitrogen, wt. %	0.096	0.072	0.23	0.17
Metals, p.p.m.				
Vanadium	1.2	−0.05	−0.10	−0.01
Nickel	0.24	−0.05	−0.10	−0.01
Characterization factor	11.7	12.0	11.1	11.5
Hydrogen consumption, S.C.F/bbl.	...	520	...	475

diate cooling between multiple reactors, etc. are unnecessary in the H-Oil system.

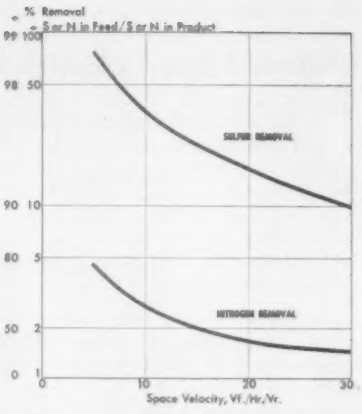
Pilot-Plant Experience

Distillate stocks have been treated in numerous pilot-plant runs at Trenton. However, the results of two relatively long runs made recently summarize the efficacy of the process in its present form.

These runs are designated as run 72-71 and run 84-55. They were made to investigate catalyst life at conditions encompassing most applications of the process on furnace oil feeds. Run 72-71 was operated on furnace-oil feed to an age of 72 bbl. per lb., after which it was operated on heavier feeds to 78 bbl. per lb.

Run 84-55 was operated on furnace-oil feed to an age of 122 bbl. per lb. Both runs were discontinued at the point where few data of value could have been obtained from further operation.

Charge stocks. The charge stock predominantly used in the two pilot runs was the feed to the hydrogen treater in a large eastern refinery. This feed consisted of (1) virgin light distillate, (2) light catalytic cycle stock, and (3) light coker distillate. Nitrogen content is high due to coker components. The feed was obtained in 16-drum lots. These lots varied somewhat due to operating variations within the refinery.



EFFECT OF SPACE VELOCITY on sulfur and nitrogen removal in furnace-oil operation. Fig. 4.

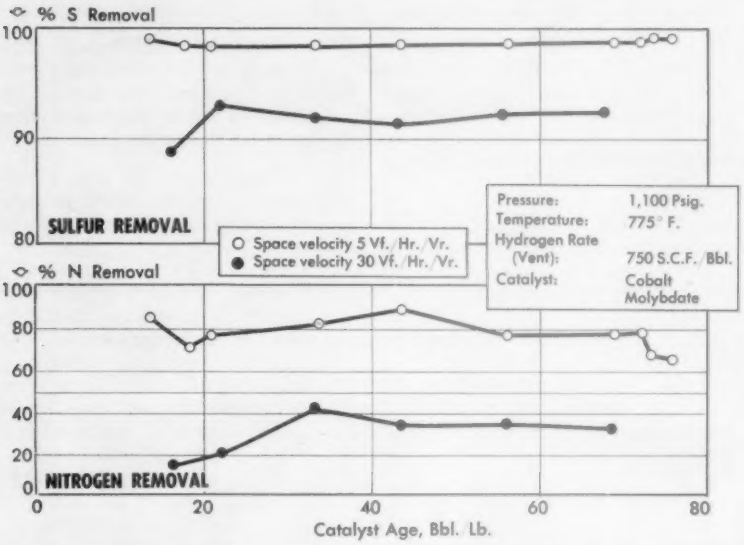
In the early operation of run 72-71, several periods were run on the light coker distillate by itself.

After attaining a catalyst age of 72 bbl. per lb. in run 72-71, subsequent operations utilized as charge (1) heavy Kuwait virgin gas oil and (2) heavy coker distillate, simulating block operation on such heavier stocks.

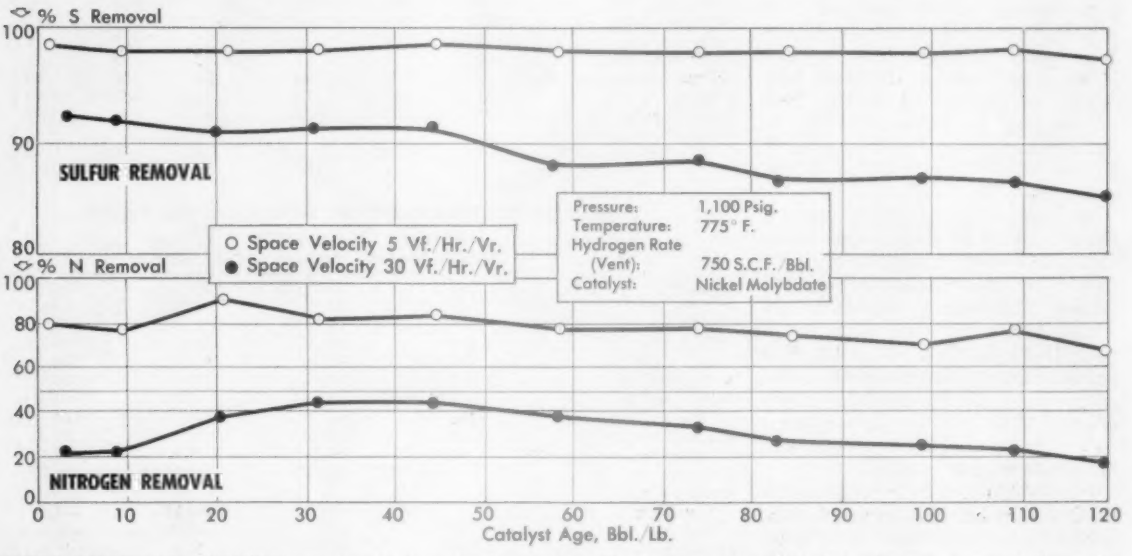
Tables 1 and 2 summarize inspections on the various feed stocks employed.

Operating conditions. These conditions were used for the greater part of both pilot runs:

Operating pressure, psig.	1100
Reactor temperature, °F.	775
Space velocity, $V_f/hr./V_r$ . . .	5-30



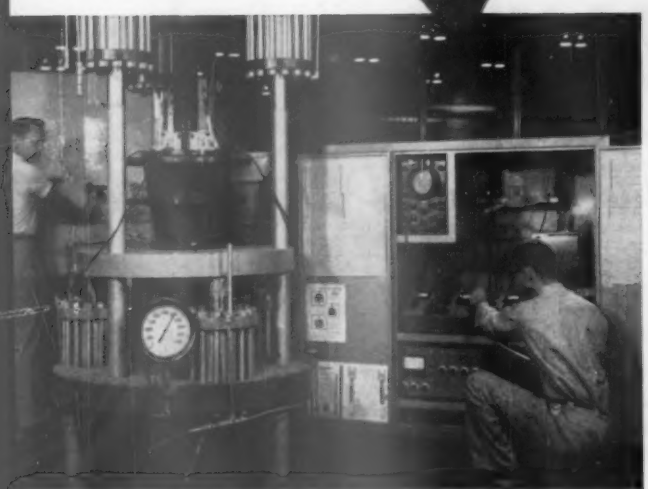
COBALT MOLYBDATE CATALYST was tested in several runs for effectiveness of sulfur and nitrogen removal from distillate. Fig. 2.



NICKEL MOLYBDATE CATALYST was tested in several runs for effectiveness of sulfur and nitrogen removal from distillate. Fig. 3.

MISSION LIGHTWEIGHT SLIPS BUILT LIKE A BRIDGE FOR STRENGTH AND LIGHTNESS

MODEL 60



Mission Slips in 600,000 lbs. capacity slip test machine, with fourteen channel recording oscillograph measuring strains in slips and pipe.

Field and laboratory tests proved that these slips are built like a bridge with plenty of strength but no excess weight. They weigh only 135 pounds; so you won't break your back setting them. Yet, they have all the heavy-duty features you will ever need. You can hold drill pipe with hook loads of 275,000 lb. and drill pipe sizes 2⅜" through 5". The lightweight results from a new design based on sound and proved engineering principles.

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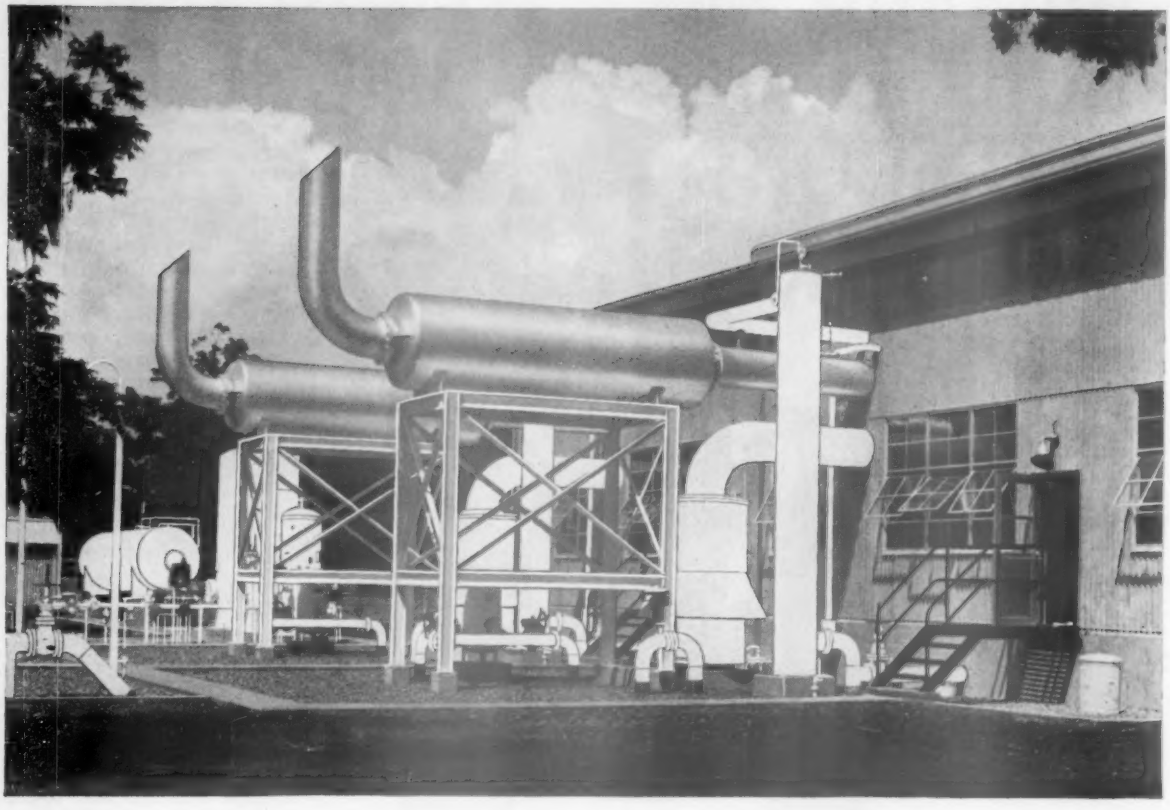

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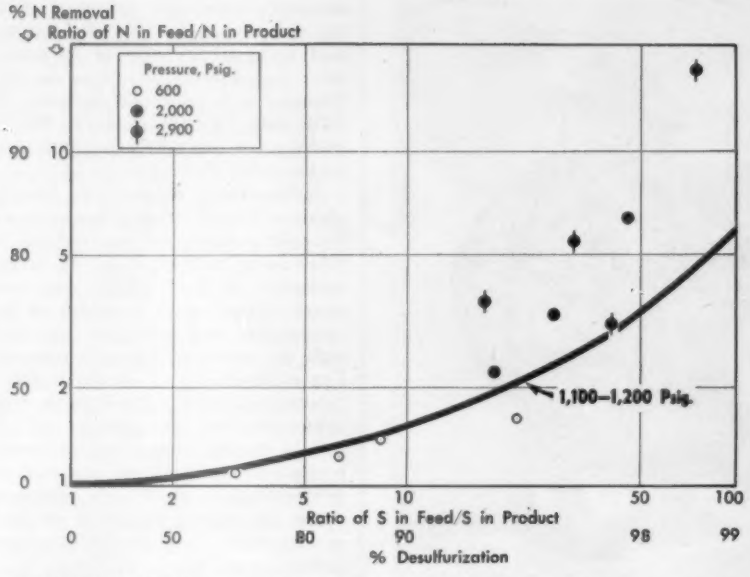


NITROGEN REMOVAL as a function of sulfur removal at different pressures in distillate treating. Fig. 5.

Space velocity, B/D/lb.	0.7-4.3
Hydrogen rate, s.c.f./bbl. (vent)	750
Recycle rate	nil

Using relatively pure hydrogen single pass, the pilot-plant pressure of 1,100 psig. roughly attains the same hydrogen partial pressure as a commercial plant operating at 1,500 psig. on reformer hydrogen with recycle.

The catalyst used in run 72-71 was a cobalt molybdate extrudate used prevalently in Trenton pilot-plant operations. The catalyst in run 84-55 was a laboratory preparation of extruded nickel molybdate.

Furnace-oil stocks. Figs. 2 and 3 illustrate sulfur and nitrogen removal in runs 72-71 and 84-55 respectively. Over a catalyst age approaching 75-100 bbl. per lb. there is only a slight deterioration in performance, part of which results from the use of a heavier charge stock late in both runs. Catalyst replacement rate in a commercial unit would be of the order of 5 lb. per 1,000 bbl. (or about 0.35 cents per barrel) to yield the average results obtained.

At 5 V/hr./V (0.7 B/D/lb.), desulfurization averaged almost 99% in both runs. At 30 V/hr./V (4.3 B/D/lb.), desulfurization averaged about 90-91% in both runs.

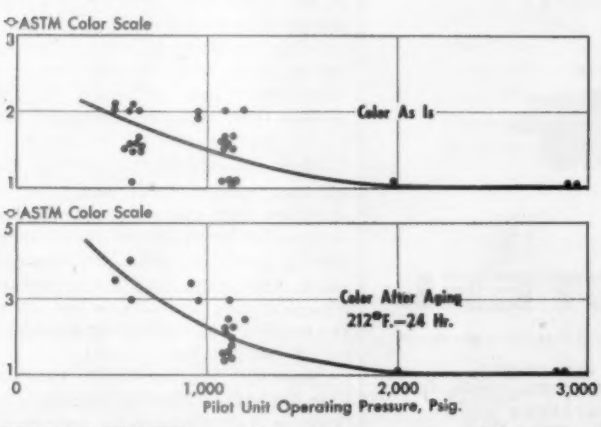
At 5 V/hr./V, nitrogen removal averaged 78% in both runs compared to about 35% nitrogen removal at 30 V/hr./V.

Fig. 4 illustrates the effect of space velocity on sulfur and nitrogen removal. On sweet stocks of relatively low nitrogen content, furnace-oil operations can be carried out at a space velocity of about 30 V/hr./V in excess of 100 B/D/ft.[3] of reactor volume. However a plant which anticipates the need for more stringent nitrogen removal and/or stability requirements is preferably designed in the range of 5 to 10 V/hr./V.

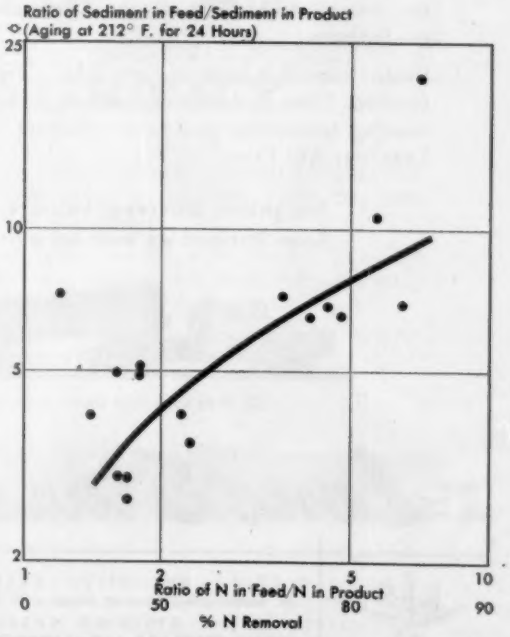
At a given level of desulfurization, nitrogen removal improves significantly with operating pressure. Fig. 5 illustrates the pilot-plant data in this respect. The line drawn in Fig. 5 summarizes the data at 1,100 psig.; the points show other data obtained at higher and lower pressures. Although showing some scatter, the data leave no doubt as to the pressure effect.

The stability of furnace oils treated by the H-Oil process has been evaluated by color and sediment measurements as produced and after aging for 24 hours at 212° F. in the more or less conventional accelerated test.[4] Almost all of the measurements have been on uninhibited samples as obtained from the pilot units with no precautions with respect to storage under nitrogen etc.

Treated furnace oils from runs 72-71 and 84-55 showed ASTM colors ranging from 1 to 2 with a small but



EFFECT OF PRESSURE on product color in treating of light gas oil. Fig. 6.



EFFECT OF NITROGEN REMOVAL on stability after aging in treating of light gas oil. Fig. 7.

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seemingly significant effect of pressure on product color. After accelerated aging at 212° F. for 24 hours, color ranged from 1½ to 3 on samples treated at a pilot-unit pressure of 1,100 psig. Again as shown in Fig. 6, increase in operating pressure improves color after aging.

Sediments on furnace oils directly obtained from 1,100-psig. operation on the pilot units ranged from 0-5 mg./l. After aging at 212° F. for 24 hours, sediments of 5-15 mg./l. were obtained. These values depended on the charge stock and seemingly correlated with the extent of nitrogen removal. For example, Fig. 7 illustrates feed/product sediment ratio (with both values obtained after aging at 212° F. for 24 hours), plotted against feed/product nitrogen content. When nitrogen removal is about 80%, sediment values are roughly half those obtained at conditions to give 30% nitrogen removal.

A few accelerated aging tests were obtained on products from runs 72-71 and 84 55 inhibited with 10 lb. per 1,000 bbl. of DuPont fuel-oil additive No. 2. After aging for 24 hours at 212° F., sediment values were negligible (average 1 mg./l.).

Thus, color, gum, and aging properties of furnace oils refined by the H-Oil process are satisfactory even when the charge stock has a high content of cracked components and has a relatively high nitrogen content.

Table 1 provides **complete inspections** on products obtained from H-Oil treating of light-gas-oil feeds. Apart from the improvement in sulfur and nitrogen contents and in color, gum, and stability characteristics obtained in the H-Oil process as discussed above, inspections are typical of those obtained in conventional hydrogen-treating operations.

On a given charge stock with the same degree of sulfur removal, **hydrogen consumption** in the H-Oil process is not more than 10 s.c.f. per bbl. greater than conventional processes.

When operating to 99% sulfur removal, with 80% nitrogen removal, consumption may be 25 s.c.f. per bbl. greater than obtained conventionally.

Heavy gas oils. Hydrogen processing of heavy-gas-oil feeds seems to be desirable from many aspects. The hydrogenated heavy gas oil cracks more readily, yields less coke, produces gasoline with more satisfactory octane characteristics, and utilizes less cracking catalyst than the analogous fraction which has not been treated.

However, the economic justification for such a treating operation by itself is difficult to assay and varies from case to case. For example, rela-

tively poor charge stocks (heavy coker distillates, heavy catalytic cycle gas oil, etc.) yield better payouts than obtained on virgin feeds. Hydrogen availability is also an important factor.

When furnace-oil and heavy-gas-oil treating operations are integrated, the economics of the over-all operation is improved considerably over each taken individually due to (1) capital cost-scale factors and (2) more efficient unit utilizability.

Integration of treating operations can be effected by (1) sizing for block operation of all furnace oil and catalytic feed components, (2) sizing for full furnace-oil operation and blocking in catalytic feed components when demand for furnace oil is low, and (3) combining furnace oil and catalytic feed components (or part of the latter) which are treated together.

Table 2 illustrates the results obtained on H-Oil treating of catalytic feed components. The results shown are over a catalyst aged on furnace oil to 72 bbl. per lb. H-Oil operation was at 1,100 psig. and 5 V/hr./V, actually the same operating conditions which might be used for a high-severity furnace-oil treating operation. The results show substantial improvement in properties which will improve subsequent catalytic cracking performance.

Life studies on such feeds show catalyst consumption rates corresponding to about 0.5 cents per barrel or less, depending on metals content.

Acknowledgments

Direction of the development described herein was given by P. C. Keith and E. T. Layng. Contributing greatly to the execution of the laboratory program were S. B. Alpert, A. R. Robb, and E. R. Ludwig. Engineering process studies were carried out principally by A. Strum and J. F. Campagnolo. Thanks are due to Nalco Chemical Co. and American Cyanamid Co. for supplying catalysts used in the work.

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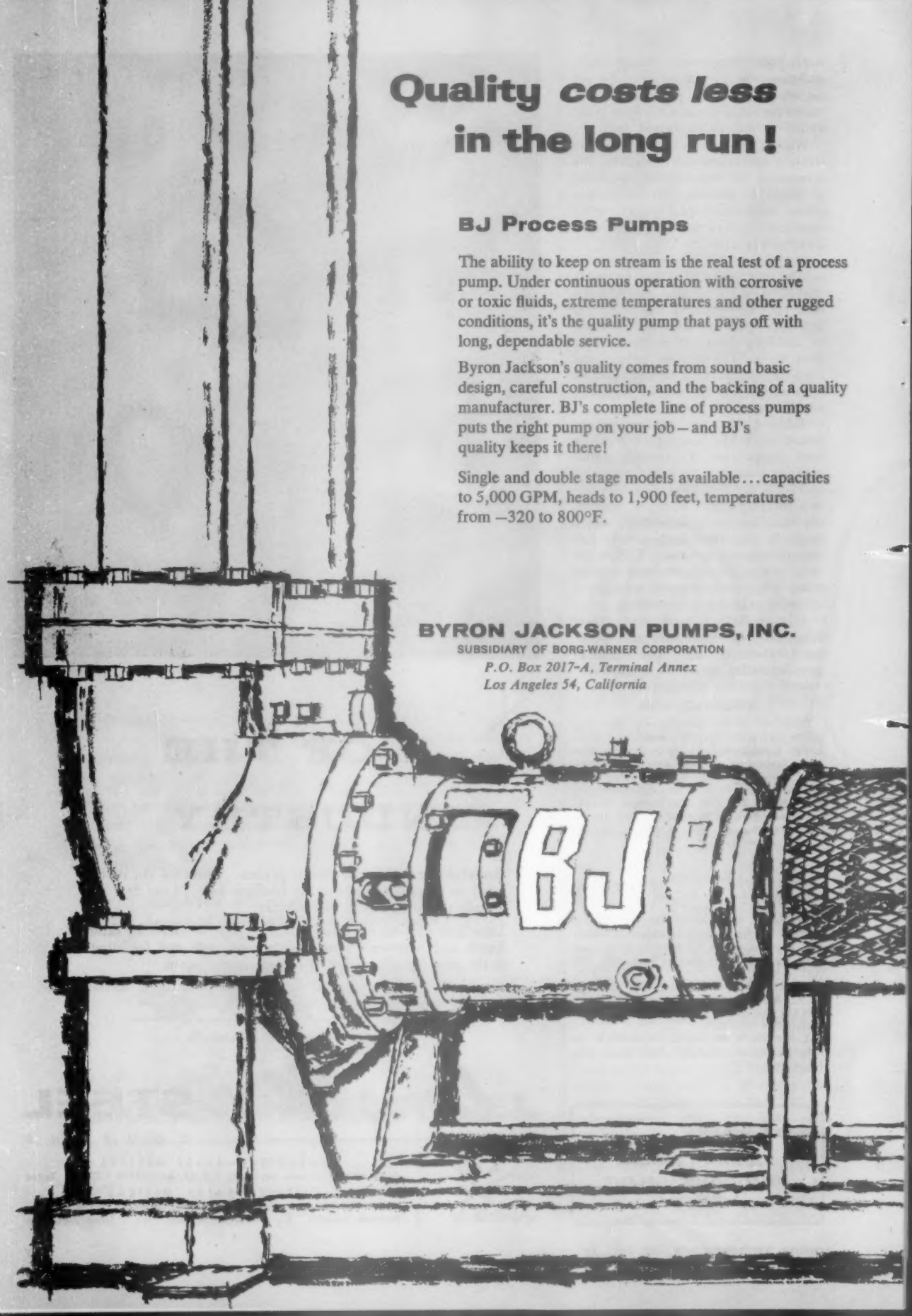

BYRON JACKSON PUMPS, INC.
SUBSIDIARY OF BORG-WARNER CORPORATION
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Wax technology faces some changes

Industry might borrow some metal-working techniques

WAX RESEARCHERS, always looking for potential uses for their products, have come up with surprising answers for years. They're still doing it.

One case in point concerns Atlantic Refining Co., which made a series of tests comparing relatively pure n-paraffins with commercial grades of paraffin wax. They found that the pure n-paraffins have, in many cases, markedly superior properties.

These results and other trends in wax technology were unveiled recently at a meeting of National Petroleum Association in Cleveland.

- Atlantic researchers pointed out that more complete separation could take advantage of the superior properties of pure n-paraffins. Coupling the new base waxes with the possibilities of new additives could open up a range of uses for wax that are not feasible with present commercial grades, they said.
- The base wax is part of the answer, but it's not the whole story, American Can Co. spokesmen warned. In a series of examples, they pointed out how certain functional properties of wax could be modified by the various available types of polyethylene resins.
- And functional tests may be on their way out as measures of quality, one spokesman said.

Atlantic's observations were drawn from a series of tests on n-C_{20} through n-C_{30} paraffins. Some of the findings:

BY KENNETH W. BROOKS
District Editor

Hardness. The n-paraffins have the same range of hardness as that reported for carnauba wax and they are tremendously hard compared to commercial grades of paraffin wax. However, n-paraffins have melting points as much as 50° F. below that of carnauba. Most of the n-paraffins reported in these studies were between 99 and 100% pure based on mass-spectrometer analysis.

Blocking temperature. When waxed surfaces are subjected to heat and pressure they may adhere to each other. Blocking temperature is a measure of this tendency.

Atlantic found that in most cases pure n-paraffins had about a 12% higher blocking temperature than commercial grades (Fig. 1).

Friction coefficient. Companies which work with waxed paper or paperboard want the lowest friction coefficient possible. The tendency to slip easily is essential to the smooth performance of automatic packaging machines.

Pure normal paraffins have a low coefficient of friction which appears to decrease slightly as melting point increases. This contrasts sharply to commercial paraffin waxes which have greater coefficients of friction at higher melting points (Fig. 2).

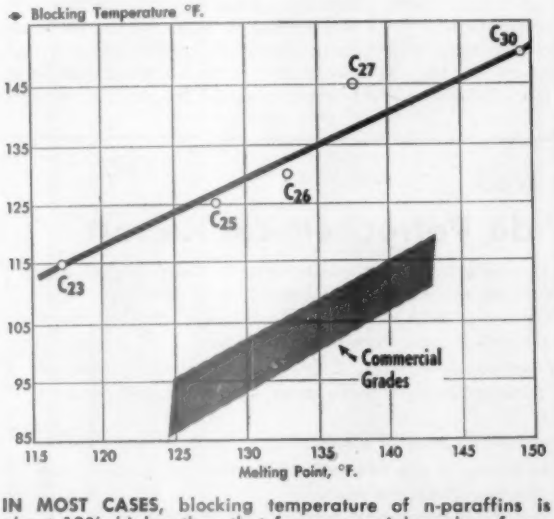
Gloss. Gloss and gloss stability are important tests which evaluate the eye appeal of a wax coating. Users want gloss because it enhances the fresh, clean appearance of a package.

With commercial paraffin wax, gloss is usually produced by rapid chilling of the wax coating after it is applied to the sheet. Surprisingly, however, Atlantic said, if pure n-paraffin coatings are slow-cooled in air, the gloss produced is much better than that for shock-chilled specimens.

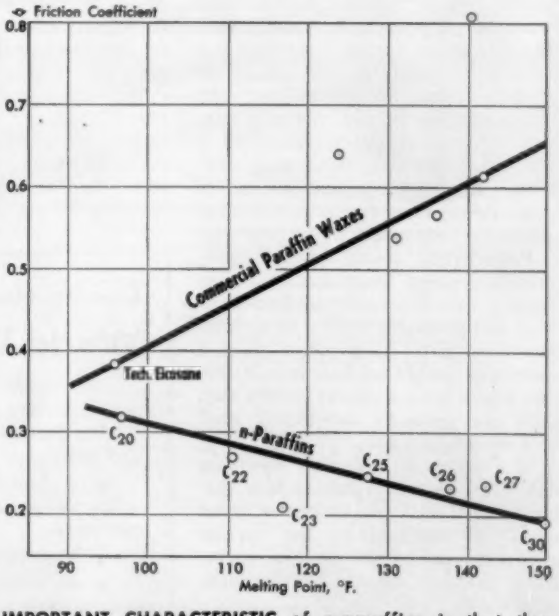
Color stability. When both types of wax have a 50% chlorine content, the pure n-paraffin has a much lighter color and this color is much more stable under either ultraviolet light or exposure to heat than its commercial counterpart.

Polyethylene Additives

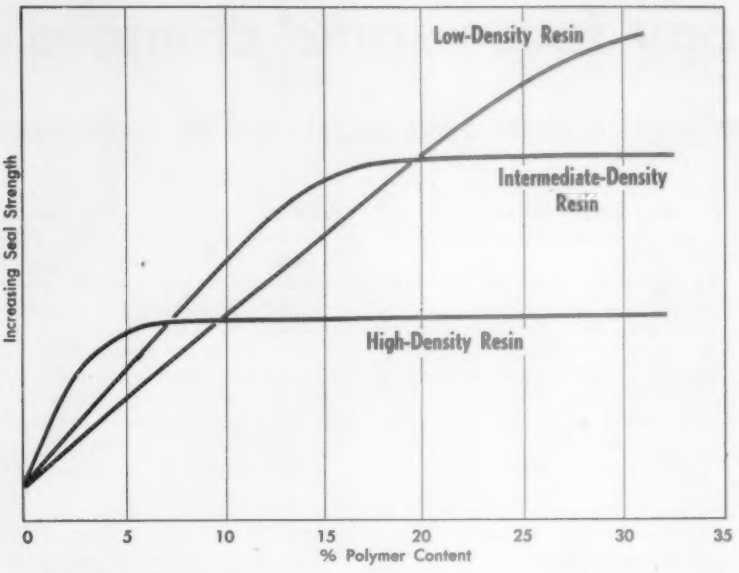
Atlantic also found that the addition of polyethylene to n-paraffins improved tensile strength to a marked degree. And the improvement was much greater than for a correspond-



IN MOST CASES, blocking temperature of n-paraffins is about 12% higher than that for commercial grades of paraffin wax. Fig. 1.



IMPORTANT CHARACTERISTIC of n-paraffins is that they have a much lower coefficient of friction than typical commercial grades. Fig. 2.



HIGH-DENSITY RESIN improves seal best at low concentrations, but no improvement is found at concentrations above 7½%. Low-density resin is best at higher concentrations. Fig. 3.

ing addition to typical commercial waxes.

As a matter of fact, almost any property can be improved by polyethylene additives, American Can Co. spokesmen said. But, they warned, you have to be careful. Although the type of polyethylene will have a great effect on the finished qualities of a blend, they said, the properties of the base wax control the magnitude of the effect.

They pointed out that with some waxes it is almost impossible to improve certain features unless large amounts of polyethylene are added. In other waxes, certain properties may be improved only at the cost of degrading others. Sometimes, they said, it happens that a base wax may have very poor properties initially, but it will have excellent response to additives. They pointed out that all of these things must be taken into consideration before selecting a base wax.

Polyethylene resins available commercially range in molecular weight from 1,500 to several hundred thousand and in density from 0.89 to 0.96. However, only those which have a molecular weight of less than 20,000 and which have a density of less than 0.94 are generally considered good wax modifiers.

In a series of examples, American Can Co. researchers showed how certain functional properties of wax could be modified by the various available types of polyethylene resins. Heat seal, for instance, is one such property.

In many packaging applications the wax coating must provide a strong, stable seal that not only will keep the package closed but will provide complete moisture protection. The wax blend must heat seal easily and should remain intact, even at low temperatures. Polyethylene additives will increase the bonding force necessary to maintain this seal.

Investigation has shown that the molecular weight of the polyethylene used affects the strength of seal to some degree. However, the density and concentration of the resin in the blend are more important. Low-density resins increase seal the best; higher density somewhat less; and the highest decreases seal below that of the pure wax (Fig. 3).

But there's another side to the story too. The degree of improvement caused by adding polyethylenes depends on the base wax with which you start. Test results shown in Fig. 3 were carried out using a 135° F.-melting-point paraffin wax and a series of six polyethylene resins ranging in density from 0.89 to 0.936.

All waxes will not show this type of additive response. Paraffin waxes, American Can Co. said, especially those melting below 140° F. usually have very low sealing strength which can be only slightly improved by addition of polyethylenes. Higher-melting-point paraffins have better initial sealing strength and better response to polyethylene additives.

Things to Watch For

To add to the wax manufacturer's problems, specifications will continue to change, Morris W. Kane, of Kalamazoo Vegetable Parchment Co., warned. Discussing the evolution of quality-control tests that suppliers have used, he predicted that wax will eventually be specified by tests more fundamental than functional.

Tests such as needle penetration, consistometer, and blocking temperature are really only measures of viscosity, he said, pointing out that rheological-temperature relationships may one day be used to control wax production.

Since wax behaves very much like metals, Kane said, the methods of metallurgy may also prove valuable in testing waxes. Solid-state physics could probably find useful application too.

He pointed out that gloss is one property which has caused much concern. The real problem, however, is stability of the surface, Kane said. It is possible to measure the theoretical maximum of about 9.4% reflection with almost any wax, even the soft micros, by mechanical means. The problem is to retain gloss under adverse temperature conditions, for long periods of time, or when exposed to abrasion. Kane pointed out that this was similar to some of the problems encountered in metallurgy and suggested that perhaps some of the same techniques could be used to solve it.

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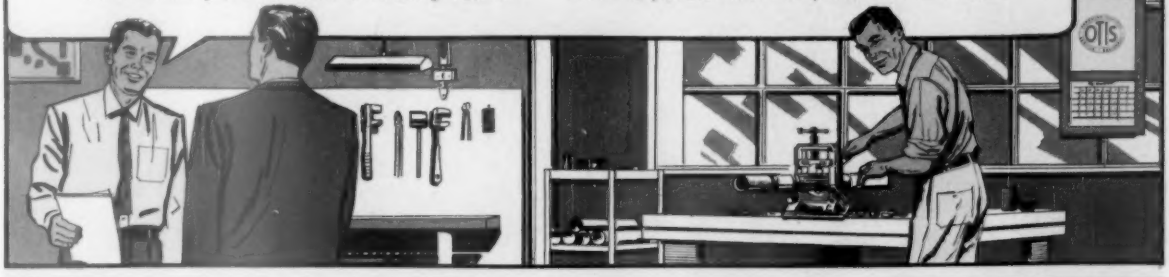
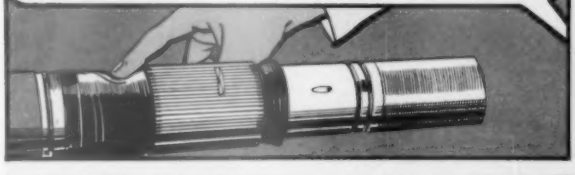
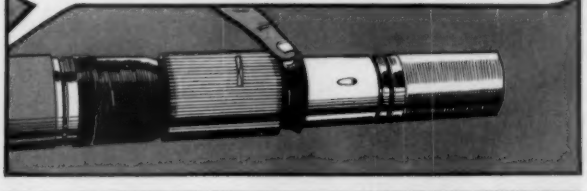


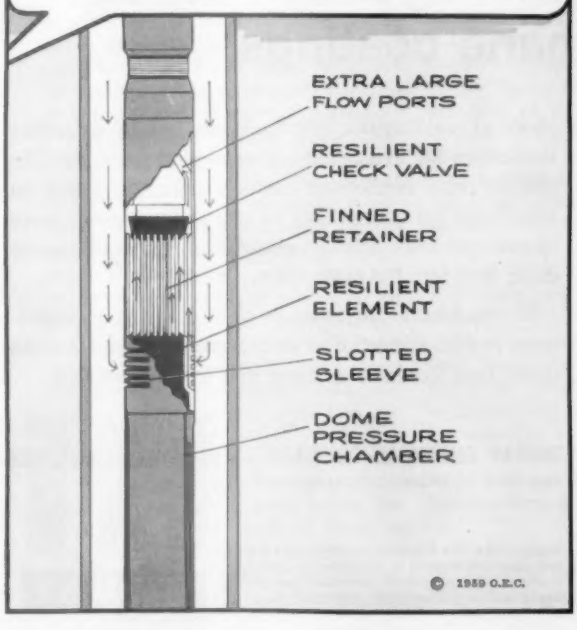
Here, let me show you the many advantages of the resilient elements in our valves. First, because this main element is resilient, it resists erosion from the system gas. Second, the flow area across the element is the largest flow area of the valve, which not only helps to reduce any cutting action from the system gas but minimizes the movement required to admit gas from the annulus during operation. These features are designed to prevent fatigue.



The same principles apply to the check valve here. It compresses just slightly as gas passes over it, then —when necessary to check back pressure from the tubing—it acts to form a bubble-tight seal against the finned retainer and inside wall of the valve. And the rubber-to-metal seal principle of both resilient elements eliminates the excessive wear normally associated with metal-to-metal, stem-and-seat type valves.



I'll show you how we bond the main valve element to the valve mandrel assembly in a minute—but first let me show you this flow diagram of our Type C Gas Lift Valve. Pressure from the valve dome holds the main valve element closed across the slotted ports. When gas pressure in the annulus exceeds the set pressure of the valve, the main valve element opens. When the pressure from the annulus drops below the set pressure of the valve, the valve closes.



Now here's how we bond the main valve element to the valve mandrel assembly. First we serrate the sealing surfaces of the mandrel assembly to give it a superior bonding surface. Then we apply a special bonding cement, slip the rubber element into place, and bake the complete assembly for one hour at 375° F. This produces a pressure-tight seal at the element end of the dome chamber. As a result, our valves can be expected to maintain their set pressure indefinitely.

If you're planning a new gas lift installation and want to RUN VALVES THAT WILL STAY IN THE HOLE and give you trouble-free service — INSTALL OTIS GAS LIFT VALVES. They have no moving metal parts . . . no bellows to fatigue . . . no metal seats to cut out . . . and they're designed to operate continuously or intermittently without having to be pulled for conversion. Contact one of our gas lift specialists at the Otis office nearest you. He'll be glad to show you these and other exclusive features and explain how Otis Gas Lift Valves are designed to save you money.

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Greater accuracy from freepoint indicators

Here's how some of the later models are performing

BY JOHN N. DONHAISER
Coordinator, Research and Development, Houston Oilfields Materials Co., Houston

WHILE the freepoint indicator has for years been extremely important in fishing for drill stem in a well, it is more important today than ever before.

Wells are drilled deeper now; drill-collar strings are longer. As a result, the freepoint indicator needs ever-greater resolving power. Moreover, inside bore of drill strings is often smaller than in the past. Thus the indicating devices have had to be packed into smaller cases.

This article tells how the freepoint indicators work and how they are designed for greater resolving power. It also describes the latest models and how they have performed in the field.

A completely accurate freepoint indicator is important because every joint of pipe or every drill collar which can be backed off above the freepoint is a joint or collar which does not have to be washed over. And, of course, washover operations are not only time consuming, but are also expensive and hazardous as well.

Two basic types. Time was when the driller guessed at the stuck point in a drill string by watching the stretch in the drill pipe when he pulled on it. Some even used tables which showed the elasticity of the pipe. Still, the method was hit-or-miss and a dependable instrument was sorely needed.

For the past several years, two basic types of instruments have been widely used to determine the point at which drill pipe or tubing is stuck. Both tools have a downhole instrument and surface-indicating equipment. The downhole instrument is run inside the drill pipe or tubing on an electric-conductor wire line which carries signals to the surface. By different means, both instruments detect stress (torque) or strain (tension or compression) when forces are applied to the pipe at the surface.

Torque and tension or compression cannot be transmitted through the drill pipe or tubing to a depth below the stuck point. As a result, a sensitive instrument which can indicate accurately stress or strain in the pipe can be used to precisely determine the depth at which the pipe is stuck in the hole.

Although the basic principles are simple, actual field application is complex because there are many variable factors. Among these are pipe diameter, internal restrictions, wall thickness, mud weight and viscosity, hydrostatic pressure, temperature, and depth. Moreover, the problem is further complicated because pipe seldom becomes stuck at a definite point. Rather, in most cases, it is stuck over some distance.

In other words, usually there is a definite distance between the point at which the indicator reads free-pipe stress and the point at which no stress or strain can be detected. This distance is often as great as several joints of drill pipe or tubing. Therefore, to recover the most pipe, the stress or strain-indicating instrument must have great enough resolving power to detect and transmit to the surface an indication of the per cent stress or strain at any point in the string of pipe.

In long strings of drill collars, accurately locating the stuck point becomes an acute problem. Indications of stress or strain are much smaller because of the heavy mass of the collars. Besides, it is difficult to produce sufficient stress or strain in the collars by pulling or twisting the much smaller drill pipe above. This problem is particularly serious in areas such as West Texas and New Mexico where it is common to run 25 or more drill collars.

Therefore an instrument to successfully locate the stuck point in a long string of collars must have not only high resolving power, but it must also be sensitive to small indications of stress or strain. Further, it must be small enough to be lowered into the smallest bore drill collars.

Strain gage. One of the two types of freepoint indicators in wide use is the strain-gage instrument. It indicates stress or strain in pipe by measuring the elastic deformation between two anchored members of the instrument. Deformation due to either stretch or torque in the pipe causes the two members of the instrument to move in relation to each other. The movement changes the electrical characteristics of the instrument and this electrical change is transmitted to surface-indicating equipment.

The instrument is calibrated so that for a given stress or strain and pipe size, there is a definite reading. If a reading is less than that indicated for free pipe, it is apparent that only a portion of the stress or strain is being transmitted to the point at which the test is made. Thus, the operator may determine the degree of pipe sticking at this point.

Magnetic device. The other type of freepoint indicator in wide use is the magnetic instrument. In one form of the subsurface probe of this type, there is an electronic oscillator and coil. The oscillator is a device which produces alternating current. Thus, direct current may be fed down the hole and high-frequency (30-50 kc. a.c.) can be produced through a simple vacuum tube or transistorized circuit.

Frequency of the alternating current can be varied by change in capacitance, resistance, or inductance of the circuit. These values are held constant except for the inductance which is supplied by the coil. When power is fed to the oscillator and coil, an electric field sets up around the coil.

When this coil is placed next to the pipe, part of the electric-field energy permeates the pipe. Result is that the pipe becomes part of the magnetic circuit and affects both inductance of the coil and natural frequency at which the instrument oscillates. If stress or strain is put on the pipe, molecular structure of the steel changes. This change also affects the magnetic field of the coil and thus, the inductance value of the coil. Result is a change in frequency of the generated signal.

This signal is transmitted up the conductor cable to surface instruments in the wire-line truck. After the signal is amplified, it is beat against a variable oscillator in the surface receiver, which may be tuned to the same frequency as the subsurface oscillator. As the variable oscillator frequency approaches that of the subsurface oscillator, the resulting difference in frequency (the beat frequency) comes into the audible range, and it may be tuned to a null point or a zero beat on the frequency meter in the surface receiver panel. Thus, any change in the oscillator frequency of the subsurface probe shows readily at the surface.

This means of detecting a change in molecular structure of the pipe indicates stress or strain transmitted downhole through the drill pipe or tubing. The change in molecular structure, like elastic deformation, generally varies proportionally with the stress or strain transmitted to the point where a reading is taken. Therefore, this type of instrument may also be used to determine the degree or percentage of freeness of the pipe at any point in the drill string.

Field practice. Both the strain-gage and magnetic types of instruments are generally run in the same manner in field practice. The subsurface instruments are lowered into the stuck drill pipe or tubing, and a series of readings are taken at various intervals in the string to determine the freepoint.

The operator usually begins by taking readings in a section of pipe known to be free in order to see the magnitude of reading for a given stress or strain. These readings vary from well to well and even in the same string of pipe because of the factors previously mentioned. Therefore, the operator must "get the feel" of any particular string or pipe and arrive at a nominal or average reading for free pipe.

As readings are taken deeper and deeper in the string of pipe, a point will be reached where no reading is obtainable. Frequently there is a zone of partially stuck pipe in which the readings are less than that for free pipe. But usually readings do not uniformly grade off from a maximum for free pipe to zero in the stuck pipe. The operator must therefore use his judgment and experience to determine the point in this zone at which the pipe can be backed off and pulled.

Problems. Due to the operating principle and to well conditions, the information desired from the tool is covered up at times. Some of the problems arising in field application are:

1. There are random inherent stresses of varying amounts in the pipe. In making a stress or strain reading, the deformation introduced can either add to or subtract from the inherent stress or strain in the pipe. Therefore, in the magnetic-type instrument, readings sometimes have variations and occasionally it is difficult to arrive at a reading indicating free pipe.

2. There is sometimes magnetism in the pipe. This too causes variations in readings in the magnetic instrument from point to point. When the tool is in the presence of a strong magnetic field, its efficiency as a stress indicator diminishes.

3. The proximity of the magnetic tool to the wall of the pipe affects its ability to detect stress or strain. Such conditions as washouts, upsets, rust, scale, pitting, mud cake, and plastic coatings may change the nearness of the tool to the pipe wall.

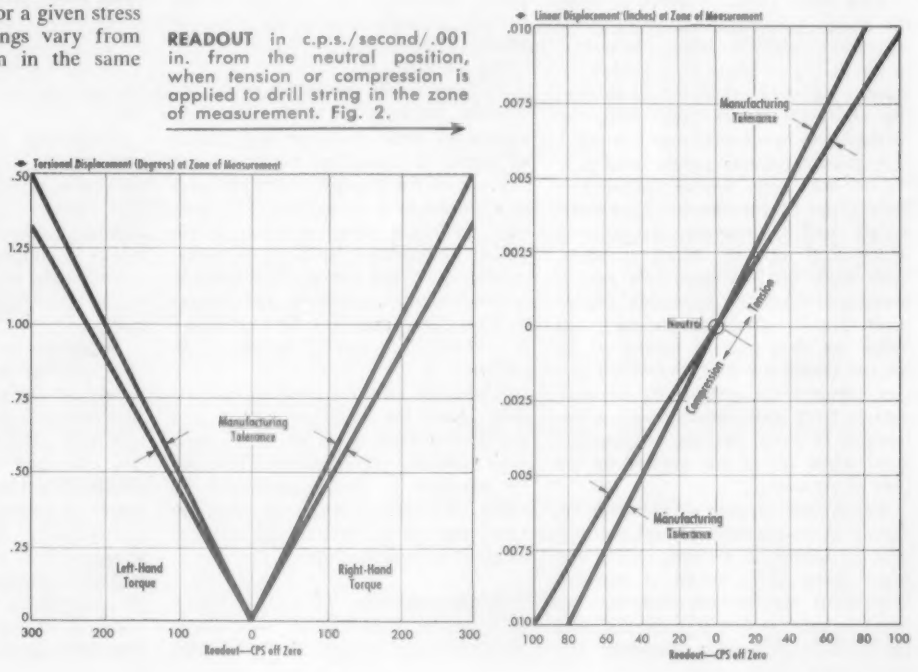
4. Great sensitivity is necessary to detect minute indications of stress or strain. And, because of the heavy mass of drill collars, the unit stress or strain transmitted through drill pipe to these drill collars is often quite small. Neither of the two types of instruments has enough sensitivity for all cases.

5. Often such tools as jars, washover backoff connectors, overshots, etc., have small bores, as little as 1½ in. Many of the strain-gage instruments cannot run through restrictions less than 1⅞ in.

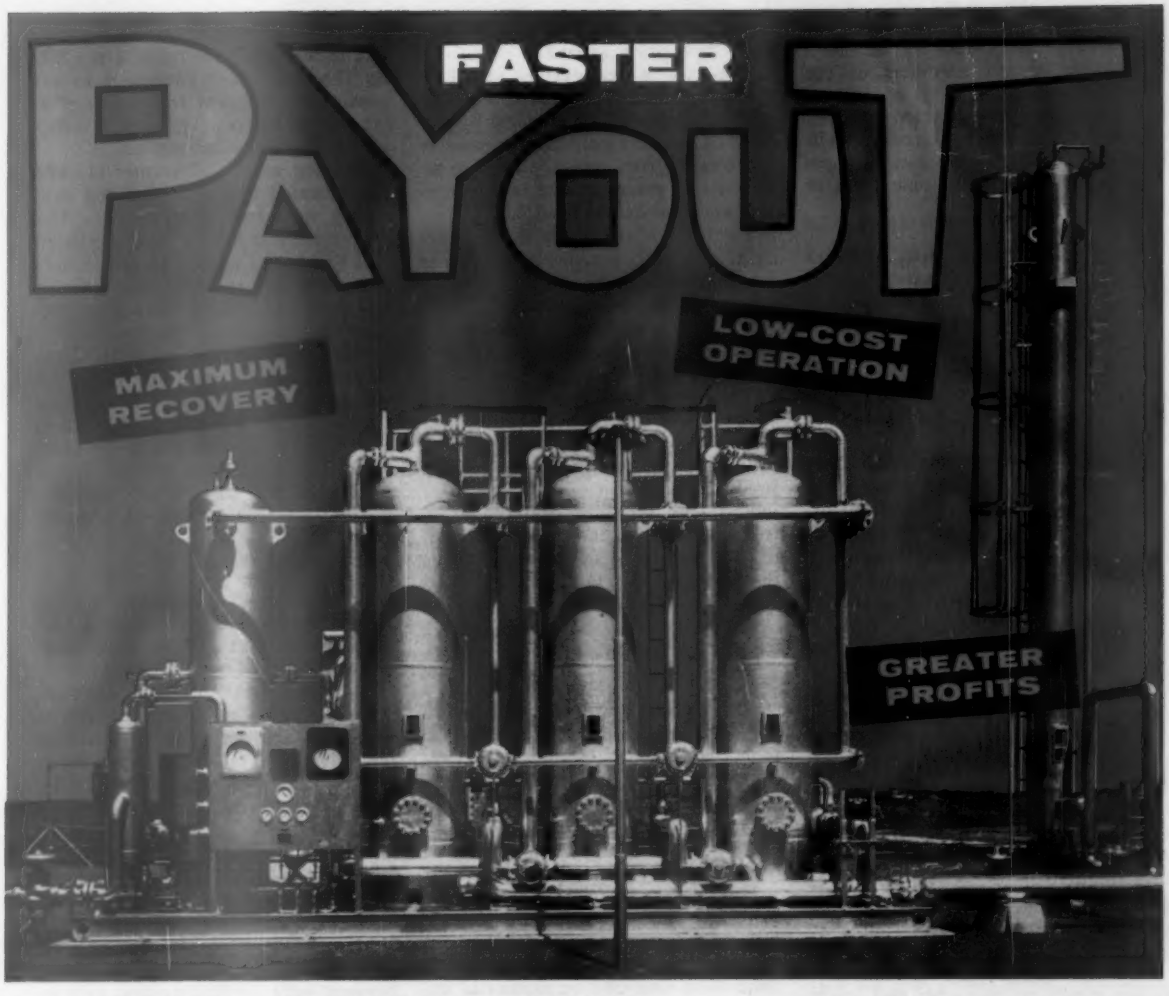
6. Many instruments depend on either permanent magnets or electromagnets to stabilize them in the hole. Internal pipe conditions, such as scale, rust, mud cake, cement, plastic coatings, etc., may detract from the effectiveness of these anchoring means. Electromagnets which require high current are also somewhat objectionable.

7. In some instruments, sensitivity falls off as hydrostatic head of drilling fluid increases. This pressure is excluded from the space within the instrument that contains the sensing element. Linkage between sensing element and anchors of the tool must be

READOUT in c.p.s./second/.001 in. from the neutral position, when tension or compression is applied to drill string in the zone of measurement. Fig. 2.



CALIBRATION GRAPHS show empirical readout at surface equipment of new freepoint indicator. Measurements are made down the hole, inside drill pipe, collars, casing, or tubing. Readout is shown here in cycles per second per degree of arc caused by torque, in left or right-hand direction. Limits of manufacturing tolerance are range of accuracy of equipment; all units are permanently adjusted during manufacture to read between these limits. Fig. 1.



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packed off, and friction caused by increased pressure reduces the relative movement of members of the sensing element.

8. Indicators are affected to some degree by high temperatures. In wells of abnormally high temperatures, there may be difficulty with some types of tools.

Long strings, deep wells. Present freepoint-indicator tools have for years done, and still do, a reasonably good job in locating the stuck point in drill pipe and tubing under many well conditions. Still, many features could stand improvement for locating freepoint in long drill-collar strings in deep wells.

HOMCO's newly developed freepoint indicator uses the basic principles as of the magnetic instrument, already described, and can be run with surface-indicating equipment currently in use. The new device generates a high-frequency magnetic field about a resonating inductive circuit. When a ferrous material is placed near, frequency of the generator changes to show stress or strain applied to the material.

For reasons already outlined, this principle has several shortcomings. HOMCO avoids these drawbacks in the following way: A miniature section of a homogeneous ferrous tubing substitutes for the drill pipe. A miniature inductive resonating circuit is placed near the ferrous tubing. This comprises a sensing element that has good linearity and resolving power.

Each end of the ferrous tube attaches rigidly to an upper and lower bowspring - stabilizer assembly which acts as supports for the tool assembly within the pipe. In general any disturbance applied to the drill pipe over the zone of the tool is transmitted to the sensing element, causing stress or strain within the ferrous tube. By using a calibrated sample of uniform ferrous material to sense stress or strain, control in readout of the tool is improved over the old system of detecting stress or strain in nonuniform sections of the drill pipe.

The sensing element is mounted within a ferrous case of high permeability. As a result, the magnetic field of drill pipe has a minimum of influence on the sensing element.

On one end of the case, there is a sub that supports one end of the sensing element. To this sub is attached the upper bowspring assembly. Other end of the case is fitted with a flexible, rubber boot and sub; to this is attached the other end of the sensing element through a friction-clutch device. This clutch protects the sensing element from damage during the trip in and out of the drill string.

To the latter sub is attached the lower bowspring assembly.

The case is hermetically sealed to the subs and air is evacuated from the internal space. It is then filled with a fluid of low thermal and compressive coefficients. As a result, there are no differential pressures due to temperature and hydrostatic head.

Electrical circuits pass through the case, subs, and bowspring assemblies to connect with the high-frequency generator and shooting head.

Improvements have also been made in design of the generator and the coil and sensing element.

The new downhole instrument, called the Stresstector, is only 1⅜-in. o.d. and can be run readily through drill pipe or tubing restrictions as small as 1½-in. in diameter. And, it indicates all forms of stress or strain transmitted down the drill pipe. With it the freepoint operator may, at his discretion, use right or left-hand torque or tension or comparison to determine a freepoint in stuck pipe. This is an advantage not found in some older tools.

Wide application. Although this new tool was designed primarily for accurately determining the freepoint in long strings of drill collars, it is more than satisfactory in most other applications. It can be used in all sizes of drill pipe, tubing, or casing.

Following are some improvements in design:

1. Coil and sensing element are shielded and are unaffected by magnetic fields that may be present in the drill pipe or collars.

2. Special bowspring stabilizers eliminate need for permanent magnets or electromagnets to anchor the tool.

3. Pressure within the tool automatically equalizes with the hydrostatic pressure outside the tool. Thus, resolving power does not diminish because of higher hydrostatic head as freepoint indications are taken deeper and deeper in the well.

4. The high - frequency generator operates without aberration at temperatures in excess of 400° F.

Field Case Histories

Many field jobs have been performed successfully by the new freepoint instrument. These jobs indicate that the tool does have great resolving power. Here are three of these jobs:

Job No. 1—April 21, 1960. In a well near Hobbs, N. M., 4½-in. drill pipe, twenty-four 7-in. o.d. drill collars, bottom-hole reamer, and bit were stuck in open hole. Total depth was 12,499 ft. The new tool found drill pipe free to top of collars. The tool entered the collars and successive torque readings were taken every 200 ft. The instrument continued to get consistently uniform free readings to the top of the reamer, without using too much torque or tension.

Reading at top of reamer (12,492 ft.) indicated that drill pipe and drill collars were free to this depth. The oil-company superintendent requested that backoff be made two drill collars above the reamer. String shot was run and positioned. Eight rounds of left-hand torque, plus five rounds for torque loss in hole were applied to the string. When the shot was fired, the collars backed off and 22 were recovered. The 7-in.-o.d. drill collars, reamer, and bit were left in the hole.

It would have been difficult, if not impossible, for some other freepoint instruments to unquestionably detect freepoint at this great depth in a long string of heavy drill collars.

Job No. 2—June 3, 1960. In a well near Snyder, Tex., 4½-in. drill pipe, eighteen 6-in.-o.d. drill collars, bottom-hole reamer, junk basket, and bit were stuck in 7⅞-in. hole. Total depth was 10,826 ft. The indicator was run into the drill collars, taking successive readings as the tool was lowered in hole. Readings were uniformly free to top of the reamer.

The indicator was pulled and the kelly put on. Oil was spotted and the pipe worked. The pipe did not work free. A string shot and collar locator were run, and the string backed off two drill collars above reamer. Recovered were 16 drill collars. Left in the hole were two collars, reamer, junk basket, and bit in hole.

This job was successful in that the instrument was accurate enough to permit recovery of the maximum number of drill collars with a single backoff run.

Job No. 3—May 28, 1960. In a hole near Fort Stockton, Tex., 4½-in. drill pipe, 7-in.-o.d. drill collars, and bit were stuck off bottom. Torque and tension readings determined that the 7-in.-o.d. drill collars were stuck in a keyseat at approximately 1,986 ft. After the freepoint indicator was pulled out of hole, an outside jar shot, made up of 1,000 ft. of 100-grain prima cord condensed to 25-ft. length was run. Top of shot was set at 1,986 ft. Weight was set on the collars and the shot fired. The collars fell free and the driller worked the pipe out of the hole.

This job is a good example of what might have been a difficult task made easy by correct interpretation of accurate and consistent tension and torque indications.

Properties of sucker rods (continued)

BY JOSEPH ZABA

IF A BAR is subjected to repeated applications of load, then the possible failure is the result of progressive damage called "fatigue." Properties of material which denote its resistance to failure under a single application of load are not a satisfactory measure of its resistance to fatigue.

Under conditions of repeated loadings the material will fail under a load smaller than that which will cause failure on one or a few applications. The ability of a material to resist fatigue failure is measured by the so-called endurance limit, defined as the maximum stress which may be applied indefinitely, under conditions of repeated loadings, without causing the failure.

The endurance limit of materials is determined on a testing machine by subjecting the test specimens to reverse loadings from maximum tension to maximum compression. Several specimens are tested to failure under gradually decreasing stresses until the stress is found under which the specimen can withstand an indefinite number of cycles of reversals. In the case of steel it has been found that a stress which permits 10,000,000 reversals without failure can be safely assumed as the endurance limit.

The results of the endurance-limit tests are plotted as the so-called S-N curves (stress-number-of-cycles-curves). They are plotted on semilogarithmic paper with ordinates as stresses and abscissa as number of cycles of reversals.

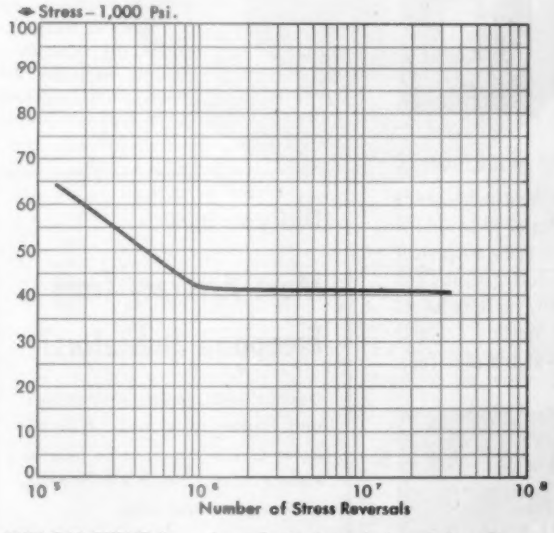
Fig. 18 shows an S-N curve for a hypothetical steel. The curve becomes horizontal at the stress of 42,000 psi., which means that this stress, or any stress below it can be applied with 10,000,000, or an indefinite number of reversals without causing a break. This stress is, therefore, the endurance limit for steel represented by the chart.

Stress raisers. The endurance limit of a material is decreased by the so-called "stress raisers." Dents, pits, scratches, or holes in the surface of a bar result in concentration of stresses leading to fatigue failure. The mechanism of this failure is generally interpreted as follows: the failure starts usually on the outside, at the base of the pit or dent, that is, at the point of stress concentration. A minute crack is formed which results in further stress concentration and further spreading of the crack. This process continues, reducing the working area of the bar until the area is reduced to the point at which the elastic limit of the material is reached and a further single application of load results in a failure.

The cross-sectional area of a fatigue break is very characteristic. The part of the progressive damage, because of the rubbing of the two parts against each other, is smooth. The part of the last elastic failure is coarse and granular. Different materials exhibit different resistances to progressive failure. Stress, range of stresses, and number of reversals are the three main factors affecting the progress to fatigue failure.

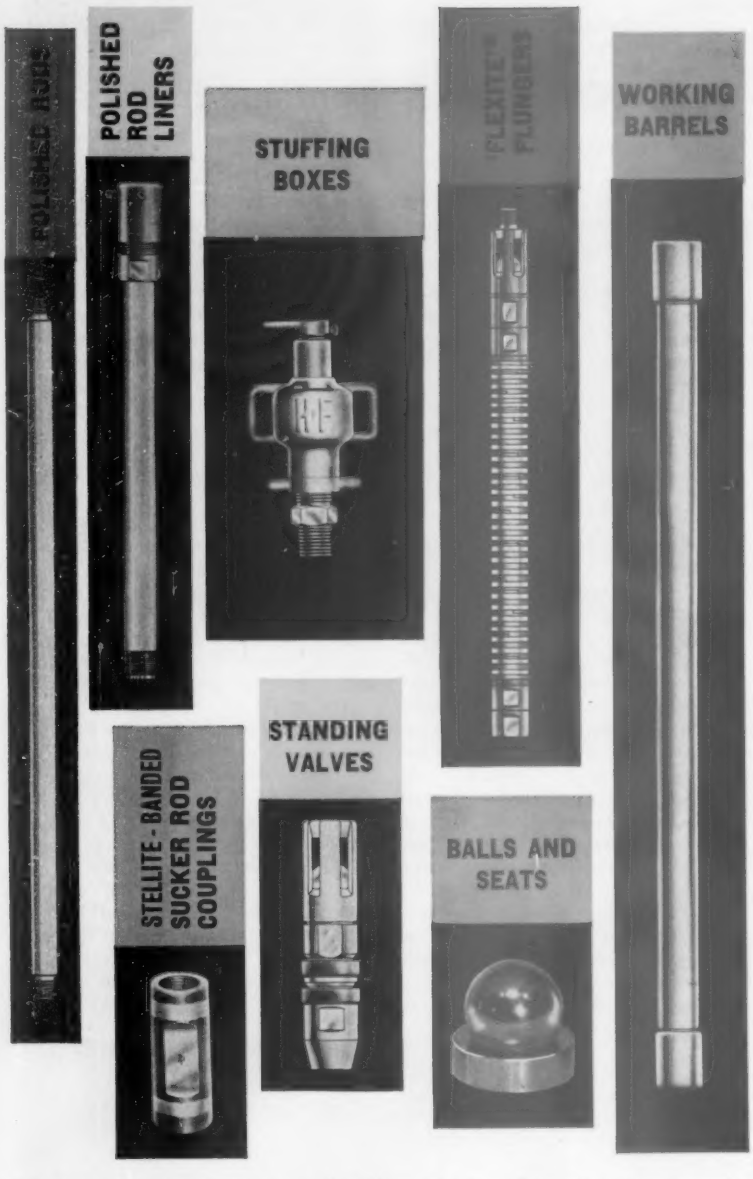
Corrosion fatigue. Oil-well sucker rods work under conditions of repeated cyclic loadings. Their service, therefore, is a problem in fatigue. There is one additional factor which affects their service and that is the presence of more or less corrosive fluids. Air-endurance limits of steels cannot always be used in selecting sucker rods for given load conditions.

The effect of corrosion on service of a sucker-rod string may be twofold. Sucker rods working under conditions of light stresses may be eventually destroyed by corrosion, or highly stressed sucker rods may fail because of corrosion fatigue. The corrosion-fatigue failure occurs in two stages. During the first stage the electrochemical action of the corrosion results in formation of pits on the surface of the rods. These pits cause stress concentration and the second stage of the corrosion-fatigue failure



THIS S-N CURVE for a hypothetical steel shows that the material has an endurance limit of 42,000 psi. An applied stress of that size can be reversed 10,000,000 times or more without failure of the material. Fig. 18.

EXCELLENT EXAMPLE of a fatigue break. Failure started in pit at top of photo and spread across rod. Note characteristic smoothness in area of progressive failure, and coarse surface where elastic failure occurred. Fig. 19.



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proceeds along the line of the fatigue described above. Fig. 19 is a typical example of a corrosion-fatigue break of a sucker rod. The small pit on the top of the rod is a result of corrosive action and the incipient point of the break. The smooth portion of the rod represents the area of the progressive damage. The granular part, at the bottom is the portion of the final elastic failure.

In case of hydrogen sulfide corrosion there may be two actions contributing to stress concentration: (1) The galvanic action between sulfide scale, formed on the rods, and the steel, with steel acting as an anode. This causes formation of pits in the rods, and (2) the hydrogen embrittlement of steel. As a result of action of sulfide on steel, hydrogen in atomic state (H) is released. This hydrogen is absorbed by the steel and migrates to the intergrain boundaries where it combines with itself to form molecular hydrogen (H_2) or with carbon compounds of steel. This results in cracking or blistering of steel.

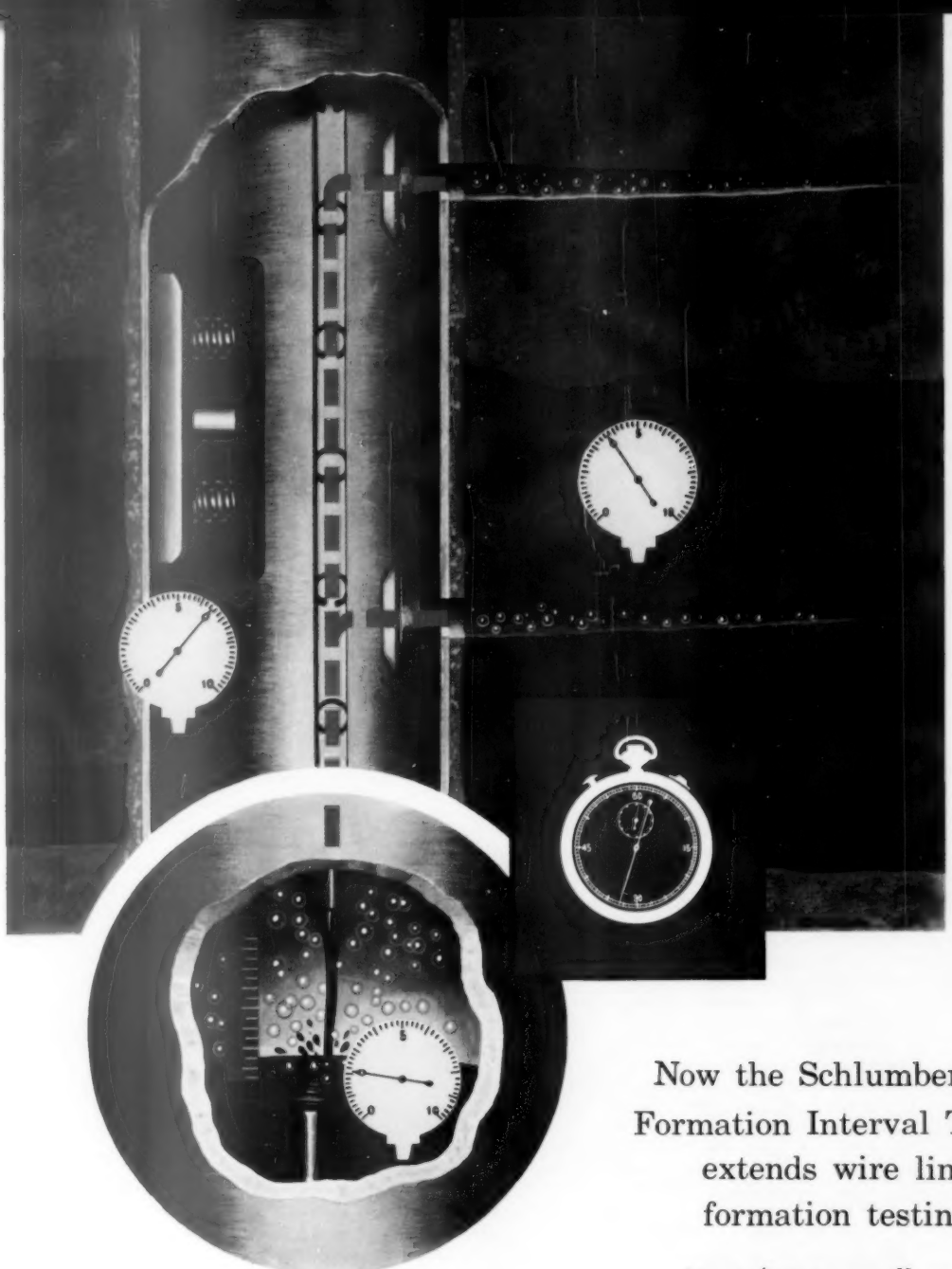
Time during which a stressed rod is exposed to a corrosive medium is an important factor in considering resistance to corrosion fatigue. If under a given set of corrosive conditions certain rods can withstand 10,000,000 reversals of certain stresses without failure, then the same stress will cause a break at a smaller number of reversals if time of their application is prolonged. Strictly speaking, therefore, there is no endurance limit to corrosion fatigue and the S-N curve does not become horizontal for the conditions of the corrosion fatigue, provided that the cycles of reversals of stresses are distributed over a sufficiently long time. This is one of the reasons why early attempts were not successful to establish, by laboratory experiments, the fatigue limits for different types of sucker rods working under different sets of well conditions.

Did you miss . . .

More Accuracy from Freepoint Indicators?

Deeper wells, longer drill strings, and higher costs mean that the point of sticking must be located more exactly when the drill string gets stuck in the hole.

Story on page 93, this issue.



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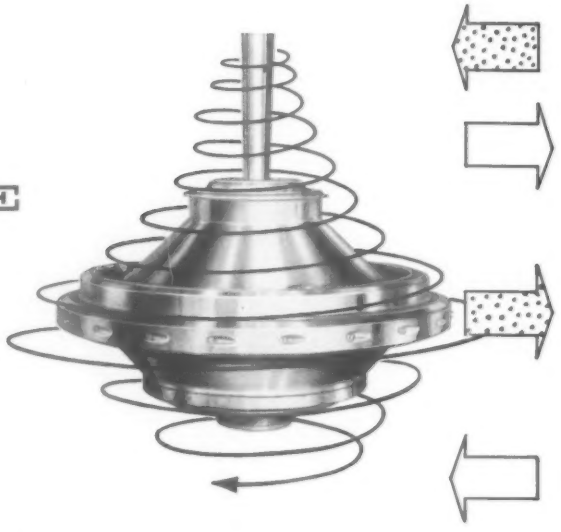

Although the centrifuge has been with us for a long time, its full potentialities are only now being realized in the processing field. Partly, this is due to the increasing demand for faster, more precise methods of separation and classification, adaptable to continuous, automatic operation. More particularly, it is due to radical new developments in the centrifuge itself.

Centrifuges have now become so versatile in operation and have advanced so much in size, power and capability that opportunities for profitable application are virtually unlimited. They are replacing filters, settling tanks, screening and other separation and classification equipment. In many cases, they are cutting days off processing time. Important, too, since the centrifuge substitutes horsepower for size, is the greatly reduced floor space requirements and the smaller amount of critical material needed when handling highly corrosive solutions.

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The
FOREMAN'S PAGE

Here are A, B, C's of

Organic and inorganic compounds

DEFINITIONS of terms to be used in this discussion of refinery chemistry were started in Part 1 (OGJ, Aug. 15), and are here continued. This is followed by a discussion of organic and inorganic compounds.

... **Mixtures** are materials which have no definite chemical composition and can be separated by physical means such as distilling, filtering, or centrifuging. Examples are milk, gasoline, crude oil, and common soil.

... **Atoms** are the smallest particles of an element which can exist and still have the properties of the element. They are the pieces that combine to form compounds. For instance, table salt is made up of one atom of sodium, which is a metal, combined with one atom of chlorine, which is a gas. The compound made of these two atoms has different properties from those of the individual atoms, and this is frequently the case.

... **A molecule** is the smallest particle of a compound which can exist and still have the properties of the compound. One atom of chlorine combined with one atom of sodium makes one molecule of table salt. This molecule of salt would be extremely small. Each grain of table salt contains about 1.4 trillion trillion molecules.

Organic compounds. To aid in classifying the thousands of different compounds, the chemist has broken them down into two main groups and many subgroups. The largest group consists of the compounds of carbon, which are called organic compounds. All of the hydrocarbons in the refinery fall in this group. The chemistry of these materials is called organic chemistry.

Inorganic compounds. The other main group of compounds, consisting of everything which does not include carbon, is called the inorganic compounds. The chemistry of these materials is called inorganic chemistry.

One of the most common refinery applications of inorganic chemistry is that of neutralization of acids. Many refinery processes involve the use of acid in contact with oils. The oils leaving these processes must be scrubbed with caustic soda or some similar compound, such as soda ash, to remove any traces of acid and protect the equipment downstream from corrosion.

The chemist shows this operation with an equation:

$$H_2SO_4 + 2\,NaOH \rightarrow$$

$$Na_2SO_4 + 2\,H_2O$$

Sulfuric acid + caustic

= sodium sulfate + water

The acid and caustic on the left are corrosive, but the sodium sulfate and the water which are formed are not. Thus the acid has been "neutralized" or made noncorrosive.

In the equation, atoms of the elements in the compounds were represented by symbols. H stands for hydrogen, S for sulfur, O for oxygen, and Na for sodium. The numbers indicate the numbers of atoms of each element in each molecule of the compound. In a sense the chemical formula is a recipe which tells the chemist what goes into making the material, much like a cake recipe tells your wife what goes into making a cake.

Another example of neutralization in the refinery is on crude stills, where they add ammonia to the distillation towers to neutralize hydrogen chloride (HCl), which is an acid. The chemist would show this reaction with the equation

$$NH_4OH + HCl \rightarrow NH_4Cl + H_2O$$

Ammonium hydroxide

+ hydrogen chloride

= ammonium chloride + water

Acids are materials which attack metals and in dilute water give a sour taste. Lemon juice and vinegar are examples of weak acids. Bases give a slimy feeling in water solution and neutralize acids. Household ammonia water is a good example of a base. We use acids and bases frequently in the refinery and it is necessary to have some way of measuring their concentration. For this we use pH if the concentration of the acids or bases is low.

When we add an acid or a base to water, the molecules of acid and base break up into electrically charged particles called ions, which the chemist shows as follows:

Caustic in water:

$$NaOH \rightarrow Na^+ + OH^-$$

Sulfuric acid in water:

$$H_2SO_4 \rightarrow 2H^+ + SO_4^{--}$$

Since acids yield hydrogen ions (H^+), the concentration of H^+ ions goes up in acid solutions. Since bases yield OH^- ions, the concentration of OH^- ions goes up in basic solutions. The pH instruments we use in the refinery measure the ion concentrations and tell us how much acid or base is present. A pH value below 7 (0-7) indicates an acid solution. A pH value above 7 (7-14) indicates a basic solution, and a pH value of exactly 7 indicates pure water or a neutral solution.

Fortunately pH can be measured quickly and accurately, so we can use pH instruments in many places where it is necessary to control the acidity of a water solution in the refinery.

They are used as acid-leak detectors on isobutylene units where their sensitivity makes it possible to detect small leaks of acid into the cooling water before the acid gets strong enough to cause serious corrosion.

On crude stills pH instruments are used to control the addition of ammonia, which is a base used to neutralize HCl in the crude and prevent corrosion. The pH tells when we need to adjust the ammonia rate to maintain complete neutralization.

This material taken from process-training-program manual, Bayway, N. J., refinery of Esso Standard Oil Co.

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Product yields indicate changing consumer needs

BY W. L. NELSON
Technical Editor and Petroleum Consultant

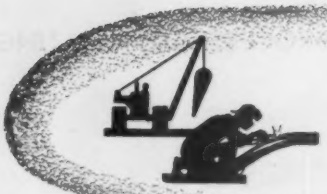
Year Ref.	Crude oil: API 1	Crude oil: Per cent 400 e.p. naphtha 1	Crude oil: Per cent sulfur 1 & 3	Approx. cap. Crude oil processed 1,000 B/D §	Approx. cap. Nat. gaso. per cent of crude oil 2	Per cent of crude oil: Kero. 2	Lubes 2	Coke 2	Asphalt 2	Total* 2	Gasoline split (approx.): Poly §	Alky. §	Thermal cracked 2	Thermal reformed 2	Cata. cracked 2	Cata. reformed §	S.R.¶
1889	..	..	..	...	...	65.9	7.7	...	..	12.8	...	...	...	...	...	...	12.8
1899	...	...	...	...	...	57.6	9.1	..	...	12.9	...	..	...	...	...	..	12.9
1904	...	..	...	..	..	48.3	11.6		...	10.3	...	...	...	...	...	...	10.3
1909	..	.	...	...	†501	33.0	10.7	..	...	10.7	...	...	...	...	...	...	10.7
1910	...	...	..	.	†574	..	...	...	...	†9.8	...	..	...	...	...	...	9.8
1911	.....	...	.	...	†623	...	...	...	...	†10.3	..	...	...	...	...	..	10.3
1912	.....	...	...	...	†640	...	...	...	...	†12.0	..	...	...	...	...	..	12.0
1913	.....	...	...	...	†715	.	...	..	...	†13.4	..	...	...	...	...	...	13.4
1914	.....	...	..	.	‡766	...	24.1-	6.6	...	†15.0	...	.	0.5	...	..	..	14.5
1915	.....	†33.0	†27.7	†0.48	‡808	...	..	...	...	...	‡18.3	..	.	1.0	...	...	.	17.3
1916	.....	...	†27.8	.	‡868	...	...	...	...	...	‡18.1	.	..	1.0	...	..	...	17.1
1917	.....	...	†28.0	..	‡988	...	13.1	5.7	..	...	21.5	...	.	1.5	...	...	...	20.0
1918	.....	...	†28.1	.	890	0.75	13.3	6.1	..	.	25.2	...	.	2.0	...	...	..	23.2
1919	.....	...	†28.3	.	990	0.82	15.4	5.6	...		25.2	...	..	3.0	...	...	..	22.2
1920	.....	†34.0	†28.5	†0.47	1,187	0.73	12.7	5.7	..	...	26.1	...	.	4.4	...	...	...	21.7
1921	.....	...	†28.4		1,210	0.57	10.4	4.7	..	...	27.1	...	..	5.2	...	...	...	21.9
1922	.....	...	†28.2		1,370	0.73	11.0	4.7			28.8	...	..	6.1	...	...	.	22.7
1923	.....	...	†28.1		1,590	1.1	9.6	4.5	0.64	2.2	30.0	...	.	7.0	...	...	...	23.0
1924	.....	...	†27.9		1,760	2.3	9.3	4.3	0.63	...	31.2	.	..	8.2	...	...	..	23.0
1925	.....	†33.0	†27.7	†0.82	2,025	2.7	8.1	4.2	0.69	2.0	32.4	...	..	9.3	...	...	..	23.1
1926	.....	...	†25.5		2,150	3.6	7.9	4.1	0.66	2.0	34.9	..	...	11.4	...	..	...	23.5
1927	.....	31.6	22.6	0.75	2,270	3.9	6.8	3.8	0.71	2.3	36.0	..	..	11.5	†0.4	...	...	24.1
1928	.....	31.4	25.7	0.88	2,500	3.9	6.5	3.8	.	.	37.4	.	..	11.7	†0.8	...	. .	24.9
1929	.....	32.3	27.2	0.80	2,700	4.7	5.7	3.5		.	39.3	..		12.6	†1.2	..	...	25.5
1930	.....	32.2	26.2	0.77	2,540	4.6	5.3	3.7	1.1	1.9	42.0	..	...	13.8	1.7	...	...	26.5
1931	.....	33.2	28.7	0.67	2,450	3.9	4.7	3.0	1.2	1.7	44.3	...	...	14.2	2.1	...	...	28.0
1932	.....	34.4	29.4	0.65	2,240	3.1	5.3	2.7	1.1	1.7	44.7	...	.	14.6	2.5	...	...	27.6
1933	.....	35.4	30.6	0.54	2,360	2.9	5.7	2.8	0.89	1.5	43.7	...	.	15.0	2.8	...	...	25.5
1934	.....	35.0	30.0	0.55	2,450	3.1	6.0	2.9	0.70	1.6	43.1	...	...	15.4	3.2	...	...	24.5
1935	.....	35.0	30.4	0.56	2,640	3.2	5.8	2.9	0.74	1.7	44.3	...	...	15.9	3.5	...	...	24.9
1936	.....	35.9	30.6	0.55	2,920	3.2	5.3	2.9	0.72	1.9	44.1	...	...	16.5	3.6	...	...	24.0
1937	.....	.	†29.9	.	3,240	3.3	5.5	3.0	0.53	1.8	43.9	†0.2	...	16.8	3.7	...	...	23.2
1938	.....	...	†29.1	.	3,190	3.3	5.5	2.6	0.67	2.0	44.2	†0.5	...	17.1	3.7	†0.2	...	22.3
1939	.....	...	†28.4		3,360	3.1	5.5	2.8	0.65	2.1	45.0	0.9	...	17.0	3.8	†0.5	...	22.8
1940	.....	†34.0	†27.8	†0.59	3,540	3.0	5.7	2.8	0.57	2.2	43.2	1.3	...	16.6	3.9	1.1	...	20.3
1941	.....	...	†27.8		3,850	3.4	5.2	2.8	0.56	2.5	44.3	1.3	..	19.5	4.3	1.2	...	18.0
1942	.....	...	†27.8		3,660	4.2	5.1	2.9	0.48	2.5	39.9	1.4	...	19.0	4.8	1.4	...	13.3
1943	.....	...	†27.8		3,920	4.3	5.0	2.7	0.46	2.5	37.2	1.4	0.3	17.7	5.7	1.8	...	10.3
1944	.....	...	†27.8		4,550	4.0	4.7	2.5	0.52	2.2	39.5	1.4	0.7	16.0	5.5	3.7	...	12.2
1945	.....	..	†27.8	†0.62	4,700	4.1	4.7	2.4	0.57	2.2	40.7	1.5	1.1	14.7	5.7	6.3	...	11.4
1946	.....	.	†27.8	†0.63	4,740	3.6	6.2	2.7	0.61	2.6	39.6	1.4	1.2	15.0	4.8	6.8	...	10.4
1947	.....	...	†27.8	†0.65	5,070	3.8	6.2	2.9	0.63	2.7	40.2	1.3	1.3	13.7	4.7	7.3	...	11.9
1948	.....	...	†27.8	†0.70	5,610	3.7	6.2	2.6	0.70	2.5	40.0	1.2	1.4	13.3	4.5	7.5	...	12.1
1949	.....	†34.0	†27.8	†0.67	5,320	4.4	5.4	2.4	0.87	2.5	44.0	1.1	1.5	12.0	4.1	8.5	†0.3	16.5
1950	.....	...	†27.6	†0.66	5,730	4.5	5.8	2.6	0.83	2.8	43.1	1.2	1.7	11.6	3.8	10.3	0.8	13.7
1951	.....	33.5	†27.4	†0.68	6,500	4.2	5.9	2.7	0.80	2.8	42.5	1.2	1.9	10.6	3.7	10.2	1.2	13.7
1952	.....	...	†27.4	†0.67	6,680	4.3	5.6	2.4	0.74	2.9	42.5	1.3	2.0	9.7	3.6	10.5	1.8	13.6
1953	.....	...	†27.3	†0.67	7,000	4.4	5.0	2.2	0.85	2.8	43.9	1.3	2.1	9.5	3.4	11.5	2.4	13.7
1954	.....	...	†27.2	†0.67	6,958	4.6	5.0	2.2	0.96	2.9	43.9	1.2	2.3	8.4	3.3	12.1	3.0	13.6
1955	.....	..	†27.1	†0.66	7,480	4.6	4.5	2.1	1.0	2.9	44.1	1.5	2.5	6.7	3.2	13.8	5.6	10.8
1956	.....	..	†27.1	†0.65	7,937	4.7	4.2	2.0	†1.1	†3.0	43.4	1.6	2.8	6.2	2.8	14.2	8.8	7.0
1957	.....	†32.5	†27.0	...	7,919	5.2	3.8	1.9	†1.2	...	43.8	1.5	2.9	5.5	2.4	14.3	11.1	6.1
1958	.....	...	...	..	7,642	5.4	3.9	1.8	†1.2	3.3	45.2	1.5	3.2	4.8	2.0	14.9	13.5	5.3
1959	.....	...	...	.	7,989	†5.5	3.7	1.8	†1.2	3.2	44.9	1.4	3.6	4.5	1.7	15.4	15.6	2.7
1960†	....	...	...	†0.62	†8,100	†5.5	†3.6	†1.8	†1.1	†3.2	†45.0	1.4	3.8	4.2	1.3	15.5	16.2	2.6

*From crude oil. Additional gasoline comes from natural gasoline. †Estimate. ‡Leslie, "Motor Fuels . . .," Reinhold Publishing Co., 1925. §Mainly The Oil and Gas Journal. ¶Some straightrun gasoline used in solvents and jet fuel.

1. Nelson, W. L. (99 largest fields), The Oil and Gas Journal, July 29, 1937, p. 91—also some estimates.

2. API - Petroleum Facts and Figures (U. S. Bureau of Mines), except for latest years.

3. Shelton, McKinney and Blade, Pet. Refiner, May 1957, p. 257. Data at 5-year intervals and after 1945.



Monthly Report on PIPELINE CONSTRUCTION

PIPELINE ACTIVITY reported here is compiled from surveys by The Oil and Gas Journal among pipeline companies and construction contractors.

This summary report appears in the last issue of the Journal each month. New construction projects are reported weekly in Pipeline Briefs in the Journal's news section.

Projects are listed in three groups—U. S., Canadian, and Foreign—and according to type of line—crude, products, or natural gas.

★ The star symbol indicates the first appearance of the project in the Journal's survey.

U.S. Crude Oil Pipelines

BELLE FOURCHE PIPELINE CO., Box 1612, Casper, Wyo.
Project: 103-mile 8-in. line from Fiddler Creek field to Lance Creek, Wyo., and other lines to serve Roset, Miller Creek, and Lone Tree fields.
Status: Approved by Wyoming Public Service Commission.

CAPE PIPE LINE CO. (Sun Oil Co., Cities Service Co., Atlantic Refining Co.), Philadelphia.
Project: Line from lower Delaware Bay to Philadelphia.
Status: Proposed.

GILLETTE PIPELINE, INC., and A. W. HARTWIG, INC.
Project: A 102-mile line from Dead Horse Creek field to Casper, Wyo.
Status: Pending Wyoming Public Service Commission approval.

GREAT NORTHERN RAILWAY, St. Paul.
Project: 110 miles of 6 and 10-in. line from Lignite and Newburg fields to Minot, N. D.
Satus: Planned.

GULF REFINING CO., Drawer 2100, Houston 1, Tex.
Project: 23 miles of reroute of 10-in. near Carlyle, Ill.
Completion: December 1960.

INTERNATIONAL OIL PIPELINE CORP., New York.
Project: Would own U. S. section of 1,500-mile, 30-in. line proposed by Mid-Continent Pipe Lines, Ltd., from Edmonton, Alta., to Chicago. (See Canada).
Status: Proposed.

MATADOR PIPE LINE CORP., Denver.
Project: 175-mile line from Burke, Bottineau, and Renville counties, North Dakota, to Cromer, Man.
Status: Pending approval of Canadian National Energy Board.

NORTHWESTERN REFINING CO., Box 248, St. Paul Park, Minn.
Project: Gathering system in Rival and Lignite fields, North Dakota.
Status: Has state approval.

SERVICE PIPE LINE CO., Box 1979, Tulsa 2, Okla.
Projects: 49 miles of 2 to 16-in. gathering line to connect new leases.
Completion: Summer and fall 1960.

SHELL PIPE LINE CORP., Box 2648, Houston 1, Tex.
Project: 4½ miles of 8-in. and 6½ miles of 6-in. from East and West Burrwood fields, Louisiana, to existing 8-in. line near Delta Pipe Line's Southwest Pass station.
Completion: October 1960.

STANDARD OIL CO. OF CALIFORNIA, San Francisco.
Project: 22 miles of 8-in. from Swanson River Unit to Nikiski on Cook Inlet, Alaska.
Status: Under way.
Contractors: Sharman, Allen, Gay & Taylor, Inc., Houston.
Completion: Mid-1961.

U. S. Products Pipelines

AZTEC PIPE LINE CO. (subsidiary of Continental Pipe Line Co., 1000 South Pine, Ponca City, Okla.).
★ Project: 36-mile jet-fuel line from Artesia, N. M., to Walker Air Force Base near Roswell, N. M.
Status: Under way.
Contractor: Brodie Construction Co., Amarillo, Tex.

CENEX PIPELINE CO., subsidiary of Farmers Union Central Exchange, Inc., Box G, St. Paul 1, Minn.
Project: 200-mile 8-in. line in Montana and North Dakota.
Contractors: D. Michael Curran & Co., Great Falls, Mont.; and C. E. Wilson Construction Co., Kansas City.
Completion: October 1, 1960.

HUSKY OIL CO., Cody, Wyo.
Project: About 100 miles from Cody to the Yellowstone products line west from Billings, Mont.
Contractor: W. E. Claycomb & Son Construction Co., Cody.
Completion: By October 15, 1960.

MID-AMERICA PIPELINE CO., (Missouri-Kansas-Texas Railroad), New York.
Project: 2,300-mile LPG system from West Texas-New Mexico area to upper Midwest. Size of pipe would be 8 and 10-in. with branches 4 to 8-in.
Status: Under way.
Contractor: Williams Brothers Co., Tulsa, is turnkey contractor. Subcontract for 4 to 8-in. line from Artesia, N. M., to Midkiff, Tex., awarded to McVean & Barlow, Odessa, Tex.
Completion: December 1960.

NEW HAVEN PIPELINE, INC., 515 Madison Ave., New York 22, N. Y.
Project: 12-in. line from New Haven to Hartford, Conn., and 10-in. from there to Springfield, Mass., with a 6-in. spur to Westover Air Base at Ludlow, Mass.
Status: Proposed.

PLANTATION PIPE LINE CO., Box 1743, Atlanta 1, Ga.
Project: Replacing 73 miles of 4-in. line with 8-in. between Helena and Montgomery, Ala.
Contractor: Latex Construction Co., Atlanta, Ga.
Completion: October 1, 1960.

TEXAS EASTERN TRANSMISSION CORP., Box 1189, Houston. (Jointly with Buckeye Pipe Line Co.)
Project: 90-mile extension of Little Big Inch from Lebanon to Lima, Ohio.
Completion: Fall 1960.
Project: 10 miles of 10-in. from Baytown to Mont Belvieu, Tex.
Status: Planned.
Completion: November 1960.

U. S. Natural Gas Pipelines

ALASKA PIPE LINE CO., Houston, Tex.
Project: 82 miles from Kenai Unit gas field to Anchorage.
Status: Under way.
Contractors: Williams Brothers Co., Tulsa, has contract for 74 land miles, and Sharman, Allen, Gay & Taylor, Inc., Houston, has an 8½-mile water crossing.
Completion: By October 15, 1960.

ALGONQUIN GAS TRANSMISSION CO., 25 Faneuil Hall Square, Boston 9, Mass.
★ Project: 30 miles of line in Massachusetts.
Status: Approved by FPC examiner.

AMERE GAS UTILITIES CO., Box 1273, Charleston 25, W. Va.
Project: 16 miles of 10-in. from Carbon to Wingrove, W. Va.
Completion: Late summer 1960.

ARKANSAS INDUSTRIAL PIPELINE CORP. (Arkansas Louisiana Gas Co.), Shreveport.
Project: 130 miles of 18-in. from Perla to Helena, Ark.
Contractor: Pentzien, Inc., Omaha, has contract for dual crossing on the Arkansas River near Wright.
Completion: Fall 1960.

ARKANSAS LOUISIANA GAS CO., Shreveport.
Project: About 58 miles of 2, 3, 4, and 6-in. line in various locations.
Completion: 1960.

BORDER GAS TRANSMISSION CORP. (owned by Lehman Brothers, New York investment firm, and Rio Gas Gathering Co., 615 National Bank of Commerce Building, San Antonio 5, Tex.).
★ Project: Gathering lines in Starr, Zapata, Jim Hogg, Brooks, and Webb counties, Texas.
Status: Proposed.
★ Project: Gathering lines in Dimmit, Zavala, and La Salle counties, Texas.
Status: Proposed.

CENTRAL HUDSON GAS & ELECTRIC CORP., South Road, Poughkeepsie, N. Y.
Project: 16 miles of 10-in. from Sleightsburgh to Highland, N. Y.
Status: Under way.
Contractor: C. N. Flagg & Co., Meriden, Conn.
Completion: September 1960.

CENTRAL ILLINOIS LIGHT CO., 300 Liberty St., Peoria 2, Ill.

PIPELINE CONSTRUCTION

Project: About 53 miles of 24 and 30-in. line in Peoria, Tazewell, and Marshall counties, Illinois.
Status: Under way.
Contractor: Somerville-Illinois Co., Peoria, Ill.

CENTRAL ILLINOIS PUBLIC SERVICE CO., 607 East Adams St., Springfield, Ill.
Project: 20 miles of 10-in. from the Tuscola area to the Mattoon and Charleston areas.
Completion: Fall 1960.

CITIES SERVICE GAS CO., Box 1995, Oklahoma City 1, Okla.
Project: 6 miles of 6-in. at St. Joseph, Mo.
Status: Pending FPC approval.
Project: 2 miles of 20-in. at Independence, Kans.
Status: Pending FPC approval.
Project: 13 miles of 16-in. from Alden field, Rice County, Kansas, to the company's Lyons station and 10 miles between Lyons and Wherry.
Status: Approved.

COLORADO INTERSTATE GAS CO., Box 1087, Colorado Springs.
Project: 7 miles of 20-in. in Texas Panhandle.
Status: Pending FPC approval.
Completion: 1960.
Project: 109 miles of 26-in. from Texas Panhandle to southeastern Colorado; 134 miles of 34-in. from there to Pueblo, and 107 miles of 30-in. on to Denver; 155 miles of 34-in. from Green River, Wyo., to Provo, Utah.
Status: Approved by FPC examiner.
Completion: 1960.
Project: 32 miles of 6-in. from Central Colorado to Trinidad.
Status: Pending FPC approval.
Completion: 1960.

COLORADO OIL & GAS CORP., Denver.
Project: 402-mile line from Gubik field to Fairbanks, Alaska.
Status: Proposed.

COLUMBIA GULF TRANSMISSION CO., Box 683, Houston, Tex.
Project: 6 miles of 24 and 30-in. at Mississippi River crossing near Providence, La.
Status: Under way.
Completion: November 15, 1960.

EL PASO NATURAL GAS CO., Box 1492, El Paso, Tex.
★ Project: About 100 miles of gathering lines in the Anadarko basin, Beaver County, Oklahoma.
Status: Pending FPC approval.
Project: 17 miles of 30-in. near Spokane, Wash.
Status: Pending FPC approval.
Completion: Not known.
Project: 17 miles of 8-in. in the Klamath Falls, Ore., area.
Status: Pending FPC approval.
Completion: Fall 1960.
Project: About 121 miles of 10 to 20-in. line from mainline in Oregon to Portland and Eugene.
Status: Temporarily approved by FPC.
Contractor: Hood-Rivers Associates.
Completion: Fall 1960.
Project: Permian-San Juan crossover loop, involving 119 miles of 30-in.
Status: Pending FPC approval.
Completion: 1961.
Project: Permian-San Juan crossover loop, involving about 30 miles of 30-in.
Status: Approved by FPC.
Contractor: R. H. Fulton & Co., Lubbock, Tex.
Completion: 1960.
Project: 34 miles of 20-in. from Puckett tie-in to Goldsmith, Tex.
Status: Pending FPC approval.
Completion: 1961.
Project: 23 miles of 20-in. from Goldsmith to the Eunice-Plains line, and 395 miles of 34-in. from Thistle, Utah, to near Las Vegas, Nev.
Status: Approved by FPC examiner.
Completion: 1961.
Project: Loop on the San Juan mainline, involving 27½ miles of 34-in.
Status: Temporarily approved by FPC.
Completion: Not known.
Project: About 228 miles of 30-in. from Coquat to Sonora, Tex.
Status: Pending FPC approval.
Completion: Not known.

EQUITABLE GAS CO., 420 Boulevard of the Allies, Pittsburgh, Pa.
Project: 3½ miles of 20-in. in Greene County, Pennsylvania.
Status: Temporarily approved by FPC.
Contractor: Joyce Pipeline Co., Andover, N. Y.
Completion: October 31, 1960.
Project: 17 miles of 16-in. in Marion and Monangalia counties, West Virginia.
Status: Temporarily approved by FPC.
Contractor: Joyce Pipeline Co., Andover, N. Y.
Completion: October 31, 1960.

HOPE NATURAL GAS CO., Clarksburg, W. Va.
Project: 19 miles of 20-in. in West Virginia.
Contractor: M. & R. Pipeliners, Inc.
Completion: September 1960.
Contractor: Sheppard-Geiger Construction Co., Corpus Christi, Tex.

HOUSTON TEXAS GAS & OIL CORP., Box 10400, St. Petersburg 33, Fla.
Project: 235 miles of 2 to 6-in. lateral lines.
Status: Pending FPC approval.
Completion: January 1, 1961.

IOWA-ILLINOIS GAS & ELECTRIC CO., 206 East 2 St., Davenport, Iowa.
★ Project: 25 miles of 4 and 6-in. line north of Muscatine, Iowa.
Status: Under way.
Contractor: Midwestern Contractors, Inc., Wheaton, Ill.

IRON RANGES NATURAL GAS CO., St. Paul.
Project: 79 miles of 10 and 12-in. from Grand Rapids to Hoyt Lake, Minn., and 67 miles of 12-in. from Duluth to Silver Bay, Minn.
Status: Approved by FPC.
Completion: 1960.

LONE STAR GAS CO., 301 S. Harwood, Dallas, Tex.
Project: 48-mile 20-in. line from Springtown to Irving, Tex.
Status: Under way.
Completion: September 1960.

LO-VACA GATHERING CO. (subsidiary of Coastal States Gas Producing Co., 200 Petroleum Tower, Corpus Christi, Tex.).
Project: 230 miles of 6 to 20-in. line from Live Oak County to Lavaca County, Texas.
Status: Pending FPC approval.
Completion: Late 1960 or early 1961.

MICHIGAN CONSOLIDATED GAS CO., 415 Clifford St., Detroit 26, Mich.
★ Project: 47 miles of 30-in. from Elsie to Sixlakes, Mich.
Status: Under way.
Contractor: Williams Brothers Co., Tulsa.

MICHIGAN WISCONSIN PIPE LINE CO., 500 Griswold Street, Detroit 26, Mich.
Project: 342½ miles of 24-in. and 192 miles of 30-in. main-line loops.
Contractors: R. H. Fulton & Co., Lubbock, Tex.; Bechtel Corp., San Francisco; Majestic Contractors, Inc., Houston; and Somerville Construction Co., Ada, Mich.
Completion: November 1, 1960.
Project: 92 miles of 24-in. from Appleton to Marshfield, Wis.
Status: Under way.
Contractor: Houston Contracting Co.
Completion: October 1, 1960.
Project: 85 miles of 16-in. from Weyauwega to Marinette, Wis.
Status: Under way.
Contractor: Hallmac Construction Co., Houston.
Project: 31 miles of various 4 to 6-in. laterals in Wisconsin.
Status: Under way.
Contractor: R. H. Fulton & Co., Lubbock, Tex.
Completion: October 1, 1960.

MIDWESTERN GAS TRANSMISSION CO., Houston.
Project: 504 miles of 24-in. from Emerson, Man., to Marshfield, Wis., plus 54 miles of sales laterals.
Completion: November 1, 1960.
Status: Under way.
Contractors: Bechtel Corp., 155 miles from Canadian border to Becker-Clay county line in Minnesota; Grayco Constructors, Inc., 54 miles from Becker-Clay county line to near New York Mills, Minn.; H. G. Price Co., 56 miles from New York Mills to Mississippi River; Houston Contracting Co., 109 miles from Mississippi River to Wanderoos, Wis.; Contracting & Material Co., 54 miles from Wanderoos to Chippewa River; Panama, Inc., 66 miles from Chippewa River to Marshfield, Wis.; Texas Pipeline Construction, Inc., 16 miles of laterals; and Bristow-Hyde Engineering Corp., 39 miles of laterals.
Completion: By November 1, 1960.

MISSISSIPPI RIVER FUEL CORP., 407 North 8th Street, St. Louis 1, Mo.
Project: 5 miles of 16-in. and 15 miles of 12-in. from Collinsville, Ill., to St. Jacob, Ill.
Status: Pending FPC approval.

MISSISSIPPI RIVER TRANSMISSION CORP. (Mississippi River Fuel Corp.), St. Louis.
Project: 94 miles of 18-in. from Johnsonville, Ill., to the St. Louis area.
Status: Pending FPC approval.

MONTANA-DAKOTA UTILITIES CO., 831 Second Ave., S., Minneapolis.
Project: 16 miles of 12-in. from Bridger to Fromberg, Mont.
Contractor: Sterling Construction Co., Sterling, Colo.
Completion: September 30, 1960.

MOUNTAIN FUEL SUPPLY CO., 180 East 1st South Street, Salt Lake City.
Project: 20 miles of 20-in. from Piedmont to Yellow Creek.
Completion: October 9, 1960.

MUSTANG FUEL CORP., affiliate of Oklahoma Resources Development Co., Cameron Building, Oklahoma City.
Project: About 170 miles of 12-in. trunk line from Oklahoma City to Harrah and Muskogee, Okla., and about 130 miles of 4 to 12-in. lateral in Central Oklahoma.
Contractors: Sadler Brothers Pipeline Construction Co. and Montin-Harbert Pipe Line Construction Co., both of Oklahoma City.
Completion: Fall 1960.

NATURAL GAS GATHERING CO., INC., Corrigan Tower, Dallas, and **GULF RESOURCES, INC.**
Project: 31 miles of 10, 12, and 14-in. in Zapata and Starr counties, Texas.
Status: Pending FPC approval.
Completion: Fall 1960.

NATURAL GAS PIPELINE CO. OF AMERICA, 122 South Michigan Avenue, Chicago.
Project: 188 miles of 24 and 139 miles

PIPELINE CONSTRUCTION

of 36-in. loops in Oklahoma, Kansas, and Iowa.
Status: Under way.
Contractors: River Construction Corp., Fort Worth, Tex.; O. R. Burden Construction Corp., Tulsa, Okla.; and R. H. Fulton & Co., Lubbock, Tex.
Completion: Fall 1960.
Project: 5 miles of 8-in. Chitwood lateral line in Grady County, Oklahoma.
Status: Pending FPC approval.
Project: 18 miles of 4 to 10-in. Smith-Collins gathering system in Carson County, Texas.
Status: Pending FPC approval.

NIAGARA MOHAWK POWER CORP., Syracuse, N. Y.
Project: 104 miles of 12-in. from Watertown, N. Y., to Massena, N. Y.
Completion: November 1960.
Project: 22 miles of 6-in. from Massena to Malone, N. Y.
Completion: November 1960.
Project: 17 miles of 6-in. from Watertown to Carthage, N. Y.
Completion: September 1960.

NORTHERN ILLINOIS GAS CO., 50 Fox Street, Aurora, Ill.
Project: 75 miles of 30-in. from Troy Grove storage field to LaGrange, Ill.
Status: Under way.
Contractor: Contracting & Material Co., Evanston, Ill.
Completion: Early fall 1960.

NORTHERN NATURAL GAS CO., Omaha.
Project: About 100 miles of 30-in. loop line and 14 miles of 24-in. between Beaver, Okla., and Minneapolis, Minn.
Status: Under way.
Contractor: Panama-Williams Corp., Houston.
Completion: October 27, 1960.
Project: About 530 miles of 2 to 16-in. branch lines to connect 58 new communities.
Status: Under way.
Contractors: Prairie Construction Co., Lubbock, Tex.; R. E. Reutzel Co., Freemont, Neb.; Underground Constructors, Dodge Center, Minn.; C. S. LeNoir Construction Co., Austin, Tex.; and Pipeline Welding Co., Tulsa, Okla.
Project: 41 miles of varying diameter gathering lines in Ochiltree and Hansford counties, Texas.
Status: Pending FPC approval.
Project: About 21 miles of 16-in. and 26 miles of various small diameter pipeline in the Glick field, Kansas, area.
Status: Pending FPC approval.
Project: 188 miles of 24-in. and 215 miles of 30-in. from Farmington, Minn., to International border.
Status: Proposed.
Project: 83 miles of 20-in. from East Dubuque, Ill., to Janesville, Wis.
Status: Pending FPC.
Completion: Fall 1960.

OHIO FUEL GAS CO., 99 North Front Street, Columbus 15, Ohio.
Projects: About 28 miles of 5 to 20-in. line in various places in Ohio.
Completion: Summer and fall 1960.

OLD OCEAN FUEL CO. (subsidiary of Texas Electric Service Co.). Fort Worth.
Project: 364 miles of 12, 16, 20, and 24-in. from Gulf Coast south of Houston to the Fort Worth area.
Status: Under way.
Contractors: H. B. Zachry Co., San Antonio, Tex., and O. R. Burden Construction Corp., Tulsa, Okla.
Completion: December 1960.

PACIFIC GAS & ELECTRIC CO., San Francisco.
Project: 9 miles of 12-in. from Berenda Creek to Chowchilla, Calif.
Contractor: Company crews.
Completion: 1960.
Project: 8 miles of 16 and 2 miles of 10-in. Fresno reinforcement.
Contractor: Company crews.
Completion: 1960.
Project: 7 miles of 16-in. from Ignacio to Petaluma, Calif.
Contractor: Company crews.
Completion: 1960.
Project: 67 miles of line from Kettleman Hills to Morro Bay, Calif.
Project: 120 miles of 34-in. looping of Topock-Milpitas main line.
Status: Planned. Pending FPC approval.
Completion: 1961.
Project: 11 miles of 20-in. from Pittsburg to Walnut Creek, Calif.
Contractor: Using company crews.
Completion: 1960.
Project: 296 miles of 36-in. from the California-Oregon border to Antioch, Calif.
Status: Pending state approvals.
Completion: 90 miles scheduled for completion in 1960, the rest in 1961.

PACIFIC GAS TRANSMISSION CO. (Pacific Gas & Electric, San Francisco).
Project: 614 miles of 36-in. from Kingsgate, B. C., to California border near Klammath Falls, Ore.
Status: Has FPC examiner's approval.

PANHANDLE EASTERN PIPE LINE CO., 1221 Baltimore Avenue, Kansas City, Mo.
Project: 50 miles of 22-in. and 150 miles of 24-in. from Haven, Kans., to Elk City, Okla.
Status: Pending FPC approval.
Completion: December 31, 1960.
Project: 300 miles of 30-in., 18 miles of 26-in., 9 miles of 12-in., 29 miles of 8-in., and 40 miles of 6-in. loop.
Status: Pending FPC approval.
Completion: December 31, 1960.
Project: 141 miles of 4 to 16-in. gathering line.
Contractor: Hall Construction Co., Liberal, Kans.
Completion: December 31, 1960.

PEOPLES GAS LIGHT & COKE CO., 122 South Michigan Avenue, Chicago 3, Ill.
Project: 29 miles of 36-in. in the Chicago area.
Status: One portion under way.
Completion: 1960-62.

PEOPLES GULF COAST NATURAL GAS PIPELINE CO., 122 South Michigan Avenue, Chicago 3, Ill.
Project: 371 miles of 30-in. loop of present system between Texas and Chicago.
Status: Approved by FPC.
Contractors: Stanley-Bledsoe Corp.; O. R. Burden, Tulsa, Okla.; H. C. Price Co., Bartlesville, Okla.; River Construction Corp., Fort Worth, Tex.; Panama-Williams Corp., Houston; and Sharman, Allen, Gay & Taylor, Inc., Houston.
Completion: November 15, 1960.
Project: About 59 miles of various size looping of main line in Texas.
Completion: October 12, 1960.

PEOPLES NATURAL GAS CO., Two Gateway Center, Pittsburgh 22, Pa.
Projects: About 23 miles of 12 and 20-in. line in various parts of Pennsylvania.
Contractors: Joyce Western Corp., R. C. Ernst, and Laurel Ridge Construction Co., have contracts on some of the line.
Completion: October 1960.

PHILLIPS PETROLEUM CO., Bartlesville.
Project: 85 miles of 2 to 16-in. gathering lines in Eddy County, New Mexico.
Status: Under way.
Contractor: McVean & Barlow.
Completion: September 1960.

PIONEER NATURAL GAS CO., Amarillo.
Project: 21 miles of 12-in. from Sudan to Muleshoe, Tex.
Status: Pending FPC approval.
Project: 12 miles of 10-in. from Muleshoe, Tex. northward.
Status: Pending FPC approval.

PUBLIC SERVICE CO. OF NORTH CAROLINA, Gastonia, N. C.
Project: About 47 miles of 4, 8, and 10-in. in North Carolina.

RIO GRANDE VALLEY GAS CO., Box 391, Brownsville, Tex.
Project: 60 miles of 12-in. in Hidalgo, Starr, and Jim Hogg counties from Moore field area to Prado field area, replacing and reconditioning existing line.
Status: Planned.
Completion: 1961.
Project: 5 miles of 6-in. from Moore field area to North Monte Christe field, Hidalgo County.
Contractor: Own forces.
Completion: December 1960.
Project: 3½ miles of 12-in. in South Weslaco field area, Hidalgo County.
Contractor: Own forces.
Completion: December 1960.

ROCKY MOUNTAIN NATURAL GAS CO.
Project: 65 miles of gas line in southwestern Colorado to supply Collbran, Montrose, Delta, and Orchard City.
Status: Planned.
Contractor: H. C. Price Co., Bartlesville, Okla.
Completion: Fall 1960.

SOUTH TEXAS NATURAL GAS GATHERING CO. (subsidiary of Coastal States Gas Producing Co., 200 Petroleum Tower, Corpus Christi, Tex.).
Project: 30 miles of 12-in. from south Jim Wells County to the May field area in Kleburg County, Texas.
Completion: September 1960.
Project: 40 miles of 4 to 14-in. line in northwest Jim Hogg County to south Zapata County, Texas.
Status: Planned.
Completion: Late 1960 or early 1961.

SOUTHERN CALIFORNIA GAS CO., Los Angeles.
Project: 13 miles of 34-in. from San Fernando Valley to West Los Angeles.
Status: Approved.
Completion: 1960.

SOUTHERN CALIFORNIA GAS CO., and **SOUTHERN COUNTIES GAS CO. OF CALIFORNIA**, Los Angeles.
Project: 93 miles of 34-in. from Ivanpah to Newberry, Calif.
Status: Planned.
Completion: 1961.

ST. LAWRENCE GAS CO., Ogdensburg, N. Y.
Project: 75 miles of line from Cornwall, Ont., to Ogdensburg, N. Y.
Status: Approved by FPC.

TENNESSEE GAS PIPELINE CO., a division of Tennessee Gas Transmission Co., Box 2511, Houston 1, Tex.
Project: 21 miles of 16-in. gathering line from Louisiana coast to Block 46 in the Vermilion area.
Status: Pending FPC approval.
Project: 2 miles of 12-in. gathering line from Block 66 to Block 64, East Cameron area, offshore Louisiana.
Status: Pending FPC approval.
Project: 158 miles of 36-in. loop lines at various points between Kinder, La., and Centerville, Tenn.
Status: Approved by FPC.
Project: 11½ miles of 16-in., 44 miles of 12-in., and 10 miles of 10-in. off Louisiana coast.
Status: Pending FPC approval.
Project: 12 miles of 12-in. gathering line from Louisiana coast to Block 17, East

PIPELINE CONSTRUCTION

Cameron area, offshore Louisiana.
Status: Approved by FPC.
Project: 191 miles of 30 and 36-in. loop at various points in Ohio, Pennsylvania, and New York.
Status: Pending FPC approval.

TEXAS EASTERN TRANSMISSION CORP., Shreveport, La.
Project: 85 miles of 24-in. from Tamarack, to Perulack, Pa.
Status: Approved by FPC.
Project: 40 miles of 36-in. from Lambertville, to Linden, N. J.
Status: Approved by FPC.
Project: 23 miles of 20-in. from Eagle, to Chester Junction, Pa.
Status: Approved by FPC.
Project: 53 miles of 30-in. from Perulack, Pa., to Lambertville, N. J.
Contractors: Contracts for the above Texas Eastern projects are held by H. C. Price Co., Bartlesville, Okla.; Western Pipe Line, Inc., Austin, Tex.; and Sharman, Allen, Gay & Taylor, Inc., Houston. Completion in 1960.
Project: 66 miles of 30-in. loop, mostly in Louisiana and Mississippi, with some in Ohio, Pennsylvania, and New Jersey.
Status: Pending FPC approval.
Completion: Before the 1960 heating season.

TEXAS GAS TRANSMISSION CORP., Box 577, Owensboro, Ky.
Project: 29 miles of 12-in. from Slaughters to proposed storage at Greenville, Ky.
Status: Approved by FPC.
Project: 24 miles of 30-in. south of Bastrop, La., and 56 miles of 12-in. loop in Indiana.
Contractor: Western Pipe Line, Inc., Austin, Tex., has contract for the 12-in. in Indiana.
Completion: Fall 1960.
★ Project: 17 miles of 10-in. from its existing 20-in. line near Thibodaux, La., to a proposed meter station in Bayou Chevreuil field.
Status: Approved by FPC.

TRANSCONTINENTAL GAS PIPE LINE CORP., 3100 Travis St., Houston, Tex.
Project: 23 miles of 20-in. offshore Louisiana.
Status: Under way.
Contractor: Brown & Root, Inc., Houston.
Completion: 1960.
Project: 73 miles of 8 to 16-in. offshore Louisiana.
Status: Approved by FPC.
Completion: 1960.
Project: 18 miles of 20-in. in New Jersey and Pennsylvania.
Status: Approved by FPC.
Contractor: Fulghum Contracting Corp., Harrisburg, Pa.
Completion: 1960.
Projects: 7 miles of 16-in., 69 miles of 30-in., and 269 miles of 36-in. in various states.
Status: Pending FPC approval.
Completion: 1960.

TRANSOK PIPE LINE CO., First National Building, Tulsa, Okla.
Project: 47 miles of 24-in. from Creek County to new power plant at Oologah in Rogers County, Oklahoma.
Status: Under way.
Contractor: Williams Brothers Co., Tulsa, Okla.
Completion: September 30, 1960.

TRANSWESTERN PIPELINE CO., 618 First City National Bank Building, Houston 2, Tex.
★ Project: 250 miles of gathering lines in West Texas and the Anadarko basin.
Status: Temporarily approved by FPC.

TRUNKLINE GAS CO., Box 1642, Houston.
Project: 31 miles of 30-in. from Longville to Pitkin, La.; 58 miles of 30-in. from Riverton to Kilbourne, La.; 63 miles of 30-in. from Ballentine, Miss., to Canadaville, Tenn.; 65 miles of 30-in. from Bardwell, Ky., to Marion, Ill.; and 35 miles of 30-in. from Neoga to Bourbon, Ill.
Contractor: Stanley-Bledsoe Corp., Tulsa, has double-jointing contract for 78 miles in Mississippi, Tennessee, and Louisiana.
Project: 140 miles of supply lateral in South Louisiana, including a 17-mile 24-in. loop of an existing lateral and 123 miles of 20, 24, and 26-in.
Status: Pending FPC approval.
Completion: Fall 1960.
Project: 177 miles of 30-in. loops in Louisiana, Arkansas, Mississippi, Tennessee, and Kentucky.
Status: Under way.
Contractor: Panama, Inc., Houston.
Project: 62 miles of 26-in. extension from Bourbon to Rossville, Ill.
Status: Under way.
Contractor: Contracting & Material Co., Evanston, Ill.

UNITED GAS PIPE LINE CO., Box 1407, Shreveport 92, La.
Project: 59 miles of 36-in. purchase lateral connecting Bastian Bay field, Louisiana.
Status: Pending FPC approval.
Completion: Fall 1961.

WESTERN SLOPE GAS CO., 900 Fifteenth St., Denver 2, Colo.
Project: 6 miles of 6-in. from Palisade to Cameo, Colo.
Completion: October 1, 1960.

Canadian Crude Oil Pipelines

ACT OILS, LTD.
Project: A 450-mile line from the Peace River region to tidewater at Kitimat, B. C.
Status: Proposed.

BITUMINOUS OIL PIPELINE CO. (Royalite Oil Co., and Can-Amera Oilsands Development, Ltd.)
Project: A 250-mile line from Athabasca oil sands to Edmonton.
Status: Proposed.

FEDERATED PIPE LINES, LTD., 304 Sixth Ave., SW., Calgary, Alta.
Project: 14 miles of 6-in. and 19 miles of 6 to 8-in. in Swan Hills area, Alberta, and 41½ miles of 16-in. line from Oliver to Highbridge, Alta.
Status: Under way.
Contractor: Majestic Contractors, Ltd., Edmonton.

INDEPENDENT PIPE LINE CO. (Home Oil Co.), Calgary.
Project: 1,073 miles of 36-in. from Edmonton, Alta., to Superior, Wis.; 946 miles of 34-in. from Superior to Montreal, Que.; 72 miles of 16-in. and 74 miles of 10-in. feeder lines from Calgary to Bellshill Lake, Alta.
Status: Proposed.

MATADOR PIPE LINE CORP., Denver.
Project: 175-mile line from Burke, Bottineau, and Renville counties, North Dakota, to Cromer, Man.
Status: Proposed. (See U. S.)

MID-CONTINENT PIPE LINES, LTD., Edmonton, Alta.
Project: 1,500 miles of 30-in. from Edmonton to Chicago. U. S. section to be owned by International Oil Pipeline Corp., New York City.
Status: Pending Canadian Board of Transport Commission approval. W. C. Gilman & Co., New York City, has made preliminary study.

NORTHERN PIPE LINE CO., 30 Broad St., New York 4, N. Y.
Project: 153-mile 16-in. line from Regina, Sask., to Clearbrook, Minn.
Status: Pending National Energy Board approval.

PEACE RIVER OIL PIPE LINE CO., LTD., Calgary, Alta.
Project: 233 miles of 8-in. from the Milligan Creek area of British Columbia to Trans Mountain Pipe Line in Alberta.
Status: Project canceled.
Project: 8 miles of 6-in., 45 miles of 8-in., and 17 miles of 12-in. from its Fox Creek Pump Station to Windfall, Virginia Hills, and Swan Hills fields in Alberta.
Status: Under way.
Completion: Fall 1960.

PEMBINA PIPE LINE, LTD., Drayton Valley, Alta.
Project: 70 miles of 3 to 10-in. gathering lines in Pembina field.
Contractor: Mannix Co., Ltd., Calgary.
Completion: December 15, 1960.

RANGELAND PIPE LINE CO., Calgary.
Project: 111-mile line from Cessford field to Calgary.
Status: Pending approval of Alberta government.

TRANS-PRAIRIE PIPELINES, LTD., Edmonton.
Project: 6-8-in. line from Weyburn field to Regina and Moose Jaw, Sask.
Status: Proposed.

Canadian Products Pipelines

BRITAMOIL PIPE LINE CO., LTD., Box 130, Calgary, Alta.
Project: 126-mile 6-in. line from Pincher Creek to Calgary.
Status: Pending approval of the Alberta Oil and Gas Conservation Board.
Project: 64-mile 8-in. line from Dick Lake to Edmonton, Alta.
Status: Pending approval of the Alberta Oil and Gas Conservation Board.

FOOTHILLS PRODUCTS PIPE LINE LTD., (Pembina Pipe Line Co., Mannix Co., Ltd.), Calgary, Alta.
Project: 1,300 miles of 16-in. from Alberta to Chicago.
Status: Proposed.

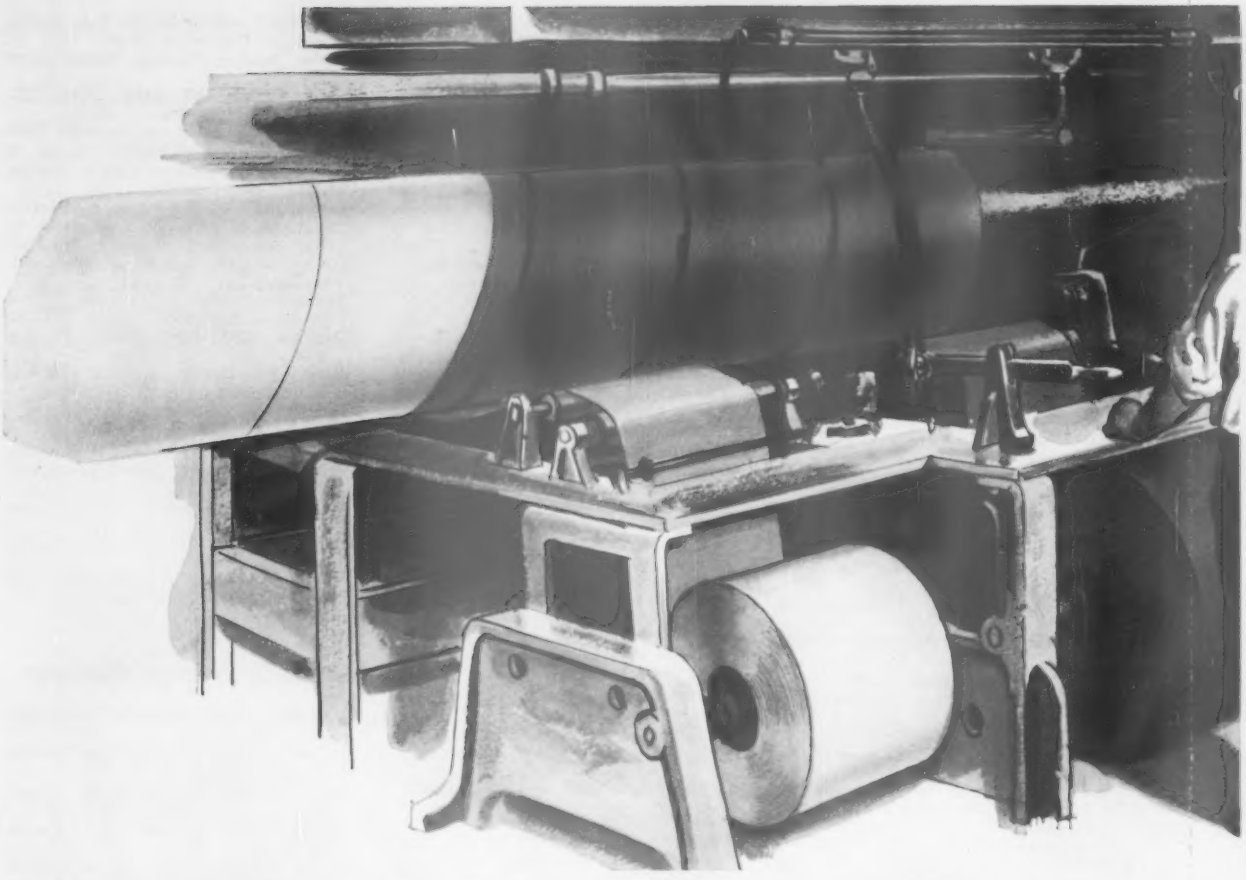
HUGHENDEN PIPELINE (c/o British American Oil Co., Ltd., 800 Bay St., Toronto).
Project: 125 miles from Dick Lake gasoline plant to underground storage in the Hughenden region of eastern Alberta.
Status: Pending approval of Alberta Oil and Gas Conservation Board.

PROVINCIAL PRODUCTS PIPELINES, LTD.
Project: 700 miles of 3½ to 16-in. line to pick up propane, butane, and condensates from natural-gas plants in Alberta for delivery to refineries and other plants.
Status: Pending approval of Alberta Oil and Gas Conservation Board.

WESTALTA PRODUCTS PIPELINE, LTD., (Pembina Pipe Line, Ltd., Edmonton, Alta.).
Project: 885-mile 4 to 16-in. gathering system to take natural-gas liquids from plants in Alberta for delivery to proposed trunkline to Great Lakes area.
Status: Pending approval of Alberta Board of Public Utility Commissioners.

Canadian Natural Gas Pipelines

ALBERTA GAS TRUNK LINE CO., LTD., Calgary.
Project: 256 miles of 36-in., 75 miles of 30-in., 55 miles of 26-in., 199 miles of various diameter gathering lines, and



Specify Johns-Manville Partners in Protection for all your pipe– mill or field wrapped

J-M BLUE FLAG for enamel reinforcement

J-M ASBESTOS FELTS for a tough outer shell

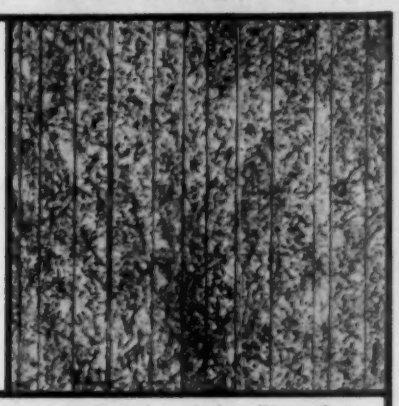
J-M FLEXIBLE ROCK SHIELD for added protection against hazards of rugged, rocky terrain

When you specify the Johns-Manville system of pipe protection, you're sure of the maximum security for your lines. Both J-M BLUE FLAG and J-M ASBESTOS FELTS are designed with modern, high-speed wrapping machinery in mind. And you get all these advantages:

- **TROUBLE-FREE APPLICATION**
  –no unusual or complicated requirements
  –long rolls of wrap mean fewer stops
- **PERMANENT BOND WITH THE PIPE**
  –no pressure-sensitive adhesive to deteriorate
  –no voids under spiral laps
  –no moisture migration
  –no "operating room cleanliness" of pipe required to secure a good bond

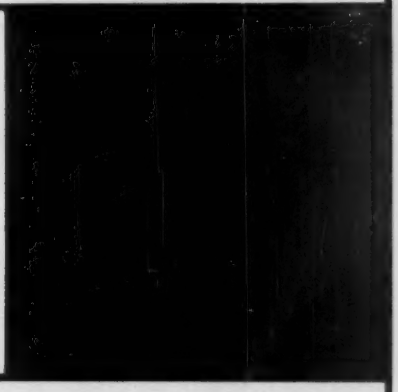
MEET 3 PARTNERS IN PIPELINE PROTECTION FROM JOHNS-MANVILLE

1



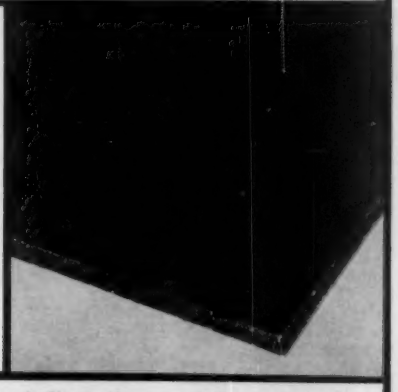
J-M BLUE FLAG Fiber Glass Wrap is a mesh of reinforced glass fibers that cannot rot, decay or absorb moisture under ground. Blue Flag lets enamel bleed through evenly until the wrap becomes an integral part of the coating. Uniform porosity prevents "holidays" as it assures consistent build-up.

2



J-M ASBESTOS FELTS, impregnated with either asphalt or coal-tar, are available in several weights to meet varied job requirements. These asbestos felts provide a flexible covering of stone, and have served as a tough outer shell on pipelines throughout the world.

3



J-M FLEXIBLE ROCK SHIELD is an asphalt-mastic composition board with a laminated felt surface. Its flexibility conforms to any pipe size, and its resilience provides the cushioning required in rugged rocky terrain.

- **DEPENDABLE RESISTANCE TO DAMAGE**
  –during handling
  –during backfilling
  –throughout the life of the pipe, J-M Blue Flag plus J-M Asbestos Felts give proven protection against soil pressures and chemicals . . . assure successful, low-cost operation of cathodic protection

- **FOR UNUSUAL CONDITIONS**, there's one more J-M Product you can use–a *third partner in protection*–J-M Flexible Rock Shield. It cushions the lines against rock penetration during backfilling and in service. J-M Flexible Rock Shield provides more dependable, lower-cost protection than dirt-padding, and conforms readily to all pipe sizes.

For further details about Johns-Manville Pipe Wrap materials–*three partners in pipeline protection*–see your nearest J-M Representative, or write to Johns-Manville, Box 158, Dept. OG-829, New York 16, N. Y.

JOHNS-MANVILLE

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JOHNS MANVILLE JM PRODUCTS

PIPELINE CONSTRUCTION

42 miles of 16-in. delivery lateral. Main line is from Berland River, Alta., to Crows Nest Pass.
Status: Approved by the Alberta and Canadian governments. Has FPC examiner's approval.

ALBERTA NATURAL GAS CO., LTD. (Pacific Gas & Electric Co., San Francisco, and Westcoast Transmission, Calgary).
Project: 108 miles of 36-in. across southeastern British Columbia to U. S. border near Kingsgate, B. C.
Status: Has Canadian and FPC examiner's approval.

CANADIAN INDUSTRIAL GAS, LTD. (formerly Ajax Petroleums, Ltd.), Derrick Building, Calgary, Alta.
Project: 28 miles of 10-in. and 4 miles of 8-in. from Morinville to Westlock Viking Sand field.
Status: Planned.
Completion: By September 1961.

CARTIER GAS CORP. (St. Maurice Gas, Inc. and Consumers' Gas Co., Toronto).
Project: 170 miles from Montreal to Quebec City.
Status: Proposed.

GAS TRUNK LINE OF BRITISH COLUMBIA, LTD., Pacific Bldg., Calgary.
Project: 250-mile, 30-in. extension of Westcoast Transmission system from Taylor, B. C., to Fort Nelson.
Status: Planned.
Completion: Late 1961.

MAGNA PIPELINE CO., LTD., Nanaimo, Vancouver Island, B. C.
Project: 25 miles of 4.85-in. double flexible plastic pipe from Huntington, B. C., to Vancouver Island.
Status: Approved by British Columbia Public Utilities Commission. Tentative timetable calls for work to start by spring 1961.

NORTHERN ALBERTA PIPE LINES, LTD., Edmonton, Alta.
Project: 110-mile trunk line, plus gathering system, from Lac La Biche, in McMurray vicinity, to Edmonton.
Status: Pending provincial approval.

NORTHERN NATURAL GAS CO., Omaha.
Project: 73 miles of 20-in. from Savanna Creek to Pincher Creek, Alta.
Status: Proposed.
Project: 32 miles of 24-in. from Pincher Creek to Montana border to tie in with planned U. S. line on to Minneapolis.
Status: Proposed.

QUEBEC GAS TRANSMISSION LINES, INC., 1610 Sherbrooke St. W., Montreal.
Project: 300-mile line from Montreal to Quebec City.
Status: Proposed.

SASKATCHEWAN POWER CORP., 1739 Cornwall St., Regina, Sask.
★Project: 49 miles of 4-in. at Claybank Ormiston.
Status: Planned.

TRANS-CANADA PIPE LINES, LTD., Toronto.
Project: 74 miles of 34-in. main-line loop (Burstall to Winnipeg, Man.) and 51-mile 30-in. lateral from Winnipeg to Emerson, Man., to connect with proposed Midwestern system now before U. S. FPC.
Status: 30-in. lateral is under way.
Contractor: Majestic Contractors, Ltd., has contract for the 51-mile lateral.
Project: An additional 390 miles of 34-in. main-line loop between Burstall and Winnipeg, Man.
Status: Planned. About 268 miles scheduled for construction in 1961, and 122 miles in 1962.

UNION GAS CO. OF CANADA, LTD., 48 Fifth St., Chatham, Ont.
Project: 12 miles of 8-in. on the Woodstock-Norwich line in Ontario.
Contractor: Majestic Contractors, Ltd., Toronto.

VAN TOR OIL & EXPLORATION CO., Vancouver, B. C.
Project: Line from British Columbia mainland to Vancouver Island.

WESTCOAST TRANSMISSION CO. LTD., Calgary.
Project: 688-mile, 30-in. loop of British Columbia-Washington line.
Status: Proposed.
Project: (See Alberta Natural Gas Co., Ltd., for joint project).

Foreign Crude Oil Pipelines

ABU DHABIE MARINE AREAS, LTD. (partly owned by British Petroleum Co., Britannic House, Finsbury Circus, London E.C. 2).
Project: 20 miles of 18-in. from offshore Persian Gulf pool to Das Island.
Completion: 1962.

ARAB PIPELINE.
Project: 1,250-mile pipeline from the Persian Gulf to Mediterranean.
Status: Proposed by Saudi Arabian Government and approved by the Arab League's petroleum department.

ARABIAN AMERICAN OIL CO., Dhahran, Saudi Arabia, and 505 Park Avenue, New York.
Project: 73 miles of 30-in. loop on Safaniya-Ras Tanura line.
Status: Under way.
Contractor: Company personnel.
Completion: October 1960.
Project: 18 miles of 34 and 36-in. from Qatif to Ras Tanura.
Status: Under way.
Contractor: Company personnel.
Completion: Third quarter 1960.

BARNABO GROUP (Italian interests).
Project: A line from Venice, Italy, to Innsbruck, Austria, which could then be extended to Munich, Germany.

BASRAH PETROLEUM CO.
Project: 65 miles of 30 and 32-in. from Zubair to Fao in southern Iraq.
Contractor: Turriff-Burden, Ltd., Tulsa.
Completion: 1961.

BOLIVIA-PARAGUAY.
Project: 500 miles of 6-in. from Southeast Bolivia to a proposed refinery on Paraguay River, and later to Asuncion.
Status: Planned.

CREOLE PETROLEUM CORP., Caracas.
Project: About 14 miles of 8 to 24-in. gathering line in Lake Maracaibo.

EASTERN BLOCK COUNCIL FOR MUTUAL ECONOMIC AID.
Project: 2,500-mile "Vomecon" pipeline from the Volga-Ural oil fields in Russia to East Europe satillites.
Status: Construction under way in Poland, Hungary, and Czechoslovakia, with completion of latter section by early 1961. Partial operation of the over-all system expected in 1963.

ENI (Italian state oil agency) and **ITALO-SWISS FINANCE CO.**
Project: A 700-mile system from Genoa to Aigle, Switzerland, thence northeast to the German border, where it would split with one branch going to Munich and another branch to the Karlsruhe area. Feeder lines would go to Turin, Milan, and Cremona, Italy.
Status: The trunk line from Genoa to Aigle approved by the Italian Government.

ESSO STANDARD (LIBYA), INC.
Project: 100 miles of 30-in. from Zelten field to Gulf of Sirte.
Status: To start construction near the end of 1960.
Contractor: Bechtel Corp., San Francisco.
Completion: Mid-1961.

GERMAN LINE planned by eight German refining and marketing companies (British Petroleum, Esso, Deutsche Erdoel, Shell, Gelsenberg-Benzin, Mobil, Schloven-Chemie, and Wintershall).
Project: 160-mile, 22-in. line to Bavaria from Karlsruhe which is the northern terminus of the big South European Pipeline Co. project from Marseille to Germany.
Status: Planned.

IRANIAN OIL PARTICIPANTS, LTD.
Project: 30 miles of 20-in. and 22 miles of 16-in. looping of Agha Jari to Bander Mashur line.
Status: Planned.

IRAQ PETROLEUM CO., LTD., 214 Oxford Street, London, W. 1.
Project: 28 miles of additional 30-in. loop in Syria.
Status: Under way.

OASIS OIL CO. OF LIBYA, 539 South Main St., Findlay, Ohio. (Other participants are Esso Sirte and Libyan American Oil Co.).
Project: 86 miles of 30-in. from the Dahra area of Libya to El Sider on the Mediterranean Coast, and 36 miles of 20-in. feeder line from the Mabruk area to the 30-in. line.
Status: Pending approval of the Libyan Petroleum Commission and the provincial government of Tripolitania.

OIL INDIA, LTD. (Burmah Oil Co. and Assam Oil Co., two-thirds, and India Government, one-third).
Project: 720 miles of line in northeast India. This will include 250 miles of 16-in. from Nahorkatiya to Noonmati and 470 miles of 14-in. from Noonmati to Barauni.
Contractors: Mannesmann, a German firm, will lay the 260-mile 16-in. system. Contract for the 460-mile 14-in. line has been awarded to an Italian Government company.
Status: To start November 1960.
Completion: The 16-in. system is scheduled for completion in March 1962.

PETROLEO BRASILEIRO S. A. (Brazil).
Project: 250-mile line from Rio de Janeiro to Belo Horizonte refinery site.
Project: 35 miles of 8 to 12-in. pipe from Buracica to Candeia.
Contractor: Techint, Inc., Milan, Italy.
Project: 80 miles of 24-in. to tie in to proposed Caxias refinery near Rio de Janeiro.
Status: Planned.

ROYAL DUTCH-SHELL.
Project: 12-mile line from Gore Bay, Australia, to Royal Dutch-Shell's Clyde refinery.
Status: Planned.
Project: 161 miles 20-in. line from Tandzung field to Balikpapan refinery, Borneo.
Status: Planned.
Contractor: Williams Brothers Overseas, Ltd., Tulsa, and John Brown, Ltd., London.
Completion: January 1, 1962.

SHELL-BP PETROLEUM DEVELOPMENT CO. OF NIGERIA, LTD., 38/39 Marina, Lagos, Nigeria.
Project: 18 miles of 12-in. line from Port Harcourt to Bonny, Nigeria.
Status: Under way.
Constructor: African Construction Co.

SOUTH EUROPEAN PIPELINE CO. (Jersey Standard, Caltex, Shell, British Petroleum, and 12 other firms.)

PIPELINE CONSTRUCTION

Project: 419 mile 30-in. line from Lavera, near Marseille, to Strasbourg, with 40-mile extension to Karlsruhe, Germany.
Status: Construction to get under way by January 1961.
Completion: 1962.

SYRIAN PIPELINE, Damascus.
Project: 500-mile line from Karshuk field, Syria, to Mediterranean.
Status: Proposed.

UNION OF SOVIET SOCIALIST REPUBLICS.
Project: 2,315 miles of 28-in. Trans-Siberian crude-products line from Ufa and Tuimazy fields in Bashkiria to Irkutsk.
Status: Under way.
(See Eastern Block for information on new East Europe line).

YACIMIENTOS PETROLIFEROS FISCALES (Argentina), Buenos Aires.
Project: 390 miles of 14-in. from fields in Neuquen Province, Argentina, to Bahia Blancha.
Status: Bids received.
Project: 625 miles of 12-in. from Mendoza to San Lorenzo.
Status: Planned.

YACIMIENTOS PETROLIFEROS FISCALES BOLIVIANOS, La Paz.
Project: 407-mile 12-in. line from Camiri to Sica Sica.
Status: Proposed.

Foreign Products Pipelines

ARABIAN AMERICAN OIL CO., Dhahran, Saudi Arabia, and 505 Park Avenue, New York.
Project: 37 miles of 8-in. LPG line from Abqaik to 'Ain Dar.
Contractor: Company personnel.
Completion: 1961.
Project: 6½ miles of 6-in. LPG line from Ras Tanura refinery to the terminal.
Status: Under way.
Completion: Fourth quarter 1960.

ESSO PETROLEUM CO., LTD., 36 Queen Anne's Gate, Westminster, London, S.W. 1.
Project: 70-mile ethylene line from the Fawley refinery to Severnside.

ESTRADA FERROVIARIA SANTOS A JUNDIAL, Sao Paulo, Brazil.
Project: 25 miles of 6-in. ethylene line from Cubatao to Rio Grande.
Contractor: Techint, Inc., Milan, Italy.

NATIONAL IRANIAN OIL CO., Teheran.
Project: 510 miles of 8-in. from Teheran to Meshed, Iran.
Status: Under way.
Contractor: Williams Brothers, Tulsa, has contract for about half this project.

NORTH ATLANTIC TREATY ORGANIZATION (Bid details from Bureau of Foreign Commerce, U. S. Department of Commerce, Washington).
Project: 57 miles of 8-in. in Germany to Land Baden-Wuerttemberg air field.
Project: 93 miles of 6-in. in Turkey.

PETROLEOS MEXICANOS.
Project: 291 miles of 8-in. from Torreon to Chihuahua.
Completion: March 1961.

PIPELINES OF PUERTO RICO, San Juan.
Project: 95 miles 8-in. from Penuelas to Catano.
Status: Approved by Puerto Rican Public Service Commission.

SYRIAN PIPELINE.
Project: About 310 miles from Homs to tank farms in the Damascus, Aleppo, and Latakia areas.

UNION OF SOVIET SOCIALIST REPUBLICS.
Project: 2,315 miles of 29-in. Trans-Siberian crude-products line from Ufa and Tuimazy fields in Bashkiria to Irkutsk.
Status: Under way.

MR. SUPERINTENDENT
MR. PURCHASING AGENT

STOP
PIPELINE LEAKS
INSTANTLY

WITH PIPE GASKET PATCH
BY DALLAS

WRITE FOR FREE LITERATURE AND INFORMATION ABOUT 25' TEST ROLL.

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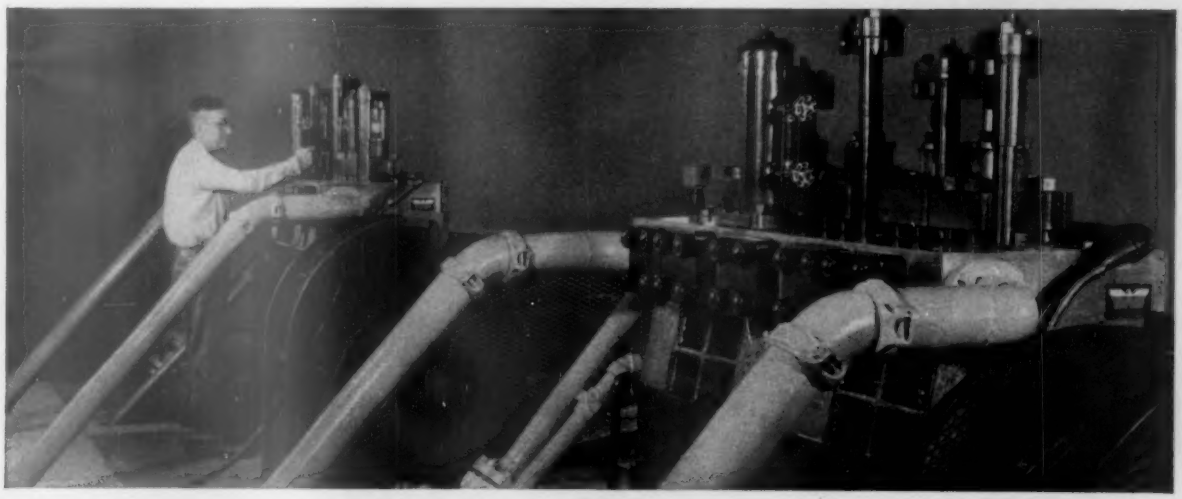


STOP AND SEE

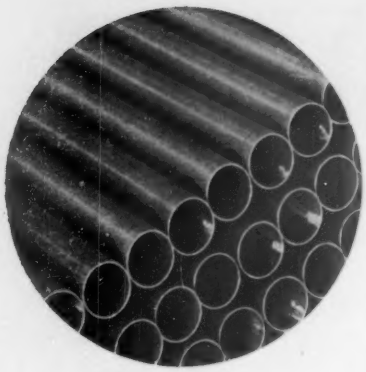
Stop and see this Blackwell Oil & Gas Company installation at their North Happy Valley Unit, Cushing, Oklahoma. It's two Worthington vertical multiplunger pumps doing a good job of handling salt water disposal . . . currently injecting 5800 and 4500 BPD each.

Since startup in 1957, these two units have put away more than 8½ million barrels of corrosive salt water. Except for routine oil changes, maintenance has been limited to servicing valves and packing an average of once a year.

You say it's not close enough to home to see? Well, we'd still like you to see a Worthington power pump installation—and talk to the operator, too. Because there are so many of these installations, there's bound to be one near you. Just call your nearest Worthington office, listed in the Yellow Pages.

We'll arrange a visit—and you can decide firsthand whether these pumps could do the job you need. A complete line of injection pumps, both horizontal and vertical, from 15 to 3000 horsepower.

WORTHINGTON



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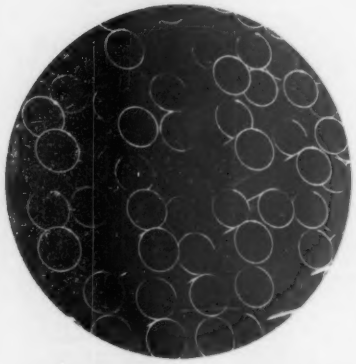
in the best circles
. . . Hi-Yield Lightwall Pipe, by Cal-Metal: custom line pipe manufacturers to the Oil and Gas Industry. Lower initial cost... lower installation costs. Call, write or wire for a quotation on your pipe requirements.



QUALITY STEEL PIPE IN SIZES 6⅝ TO 42"—LENGTHS TO 63½'.

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CAL-METAL PIPE
CORPORATION OF LOUISIANA

Sales Offices: Baton Rouge, La. Jacksonville, Fla. — Tulsa, Okla. Houston, Texas — Midland, Texas.

PIPELINE CONSTRUCTION

Project: 700 miles from Novo-Kuibyshev refinery to Bryansk.
Status: Under way.

YACIMIENTOS PETROLIFEROS FISCALES (Argentina), Buenos Aires.
Project: 652 miles of 10-in. from Lujan de Cuyo to Buenos Aires.
Status: Planned.

Foreign Natural Gas Pipelines

CREOLE PETROLEUM CORP., Caracas.
Project: 18 miles of 30-in. and about 13 miles of 8 to 24-in. from stations in Bachaquero area to the Bachaquero compressor plant.
Status: Under way.
Completion: October 1960.

GASES NATURALES DE COLOMBIA, S.A. (Owned 50% by Colombian Petroleum Co., which is affiliated with Mobil International and Texaco, and 50% by local interest.)
Project: 140 miles of 10-in. from Cicuco field to the Caribbean port of Barranquilla.
Completion: Late 1961.
Project: 75 miles from Rosh-Zohar field to Ashdod Yam.

INDIA.
Project: India plans to start formal talks with Pakistan soon concerning possibility of importing natural gas from Sui field into India.
Status: Preliminary studies indicate a pipeline to Bombay might be commercially sound.

IRAQ GOVERNMENT.
Project: A natural-gas line from Rumaila oil field to Basrah.

MENE GRANDE OIL CO., Caracas.
Project: 19 miles of 12-in. from East Soto to Zapatos.
Completion: 1960.

MEXICAN LINE.
★ Project: A 1,100-mile, 34-in. line from Reynosa, near the southern tip of Texas, to San Luis Rio Colorado, near the California border.
Status: Preliminary agreement signed by Petroleos Mexicanos and Tennessee Gas Transmission Co., Houston..

PAKISTAN INDUSTRIAL DEVELOPMENT CORP.
Project: Further extension of the Sui-Multan system into northern West Pakistan.
Status: Under consideration. Technical survey has been ordered.

PAKISTAN PETROLEUM CO.
Project: 145 miles of 8-in. from Sylhet field to Daccq, East Pakistan.
Status: Proposed.

PETROLEOS MEXICANOS.
Project: 483 miles of 24-in. from Jose Colomo field in State of Tabasco to Mexico City.
Status: Under way.
Contractors: Condusa is contractor. Contracts for eight river crossings awarded to Collins Construction Co., Port Lavaca, Tex., and Constructora Inde S. A. de C. V., Mexico City.
Completion: November 1960.
Project: 200 miles of 14-in. from Mexico City to Salamanca.
Status: Planned.
Completion: September 1961.
Project: 291 miles of 12-in. from Torreon to Chihuahua.
Completion: March 1961.

SOC. SICILIANA METANADOTTI (SOSIM). Partners include Edison Power, Italcementi, Fiat Motor, Sicilian SGES Power, Bombrini Parodi Delfino Chemical, and Montecatini.

Announcing Change of Name

FOREMAN PIPELINE INDUSTRIES

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Cleaner Pipelines Company

INTERNAL PIPELINE CLEANERS

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Durably Built
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For coated or non-coated pipelines

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SURVEYING & MAPPING

PIPE LINE SURVEYS

PIPELINE CONSTRUCTION

Project: 560 miles from Hassi R'Mel gas field, Algeria, to Cape Bon, Tunisia, 77 miles across the Sicilian Channel, and a route well into northern Italy which would run less than 1,000 miles farther.
Status: Engineering studies under way.

SOTHRA.
Project: A 315-mile system from Hassi R'Mel gas field in Algeria to the Mediterranean Coast, including 262 miles of 24-in. trunk from Hassi R'Mel to Relizane and 20-in. from Relizane to Arzew, plus branches to Oran and Algiers.
Status: Under way.
Contractors: Groupement Entrepose-Ste. Parisienne pour l'Industrie Electrique (GREP) has contract for 200 miles from Hassi R'Mel to Tiaret. Socoman has contract for 115 miles from Tiaret to Arzew.
Completion: Spring 1961.

STANDARD-VACUUM OIL CO., New York.
Project: 60 miles of 8-in. from Radja field to Palembang, Sumatra.
Status: Planned.

UNION OF SOVIET SOCIALIST REPUBLICS.
Project: Two parallel, 40-in. lines, each over 1,300 miles long, from Gazli, near Bukhara, northward to Sverdlovsk and Chelyabinsk.
Status: Planned.
Project: Line from Samarkand through Tashkent to Chimkent, Dzhambul, Frunze and Alma-Ata near Chinese border.
Completion: Line from Samarkand to Tashkent expected to be finished in 1960. Completion of rest of line expected by 1965.
Project: Line from Berezovo field southward to Sverdlovsk.
Status: Proposed.
Project: 438 miles from Dashava in Carpathian Mountains to Minsk.
Status: Under way.
Completion: 1960.
Project: Line from Minsk northward to Baltic Sea area.
Completion: To Vilnius, Lithuania, in 1961; to Riga, Latvia, in 1962.
Project: Line from Minsk northeast to Leningrad.
Status: Proposed.
Project: 405 miles from Saratov north to Gorki via Penza.
Status: Under way.
Completion: 1960.
Project: 800-mile, 32-in. loop of existing line from Stavropol fields in northern Caucasus to Moscow.
Status: Under way.
Completion: 1960.
Project: 800-mile, 40-in. line from Krasnodar fields north of Caucasus Mountains to Serpukhov, south of Moscow, via Rostov and Lugansk.
Status: Under way.
Project: 310-miles of 32-in. line ringing Moscow at radius of about 50 miles.
Status: Under way.
Completion: 1962.

YACIMIENTOS PETROLIFEROS FISCALES (Argentina), Buenos Aires.
Project: 1,000-mile line from Comodoro Rivadavia to Buenos Aires with a spur to Plaza Huincul field in Neuquen province. Line will be 26 in. to the connecting point for the Plaza Huincul link and 30 in. from the connection to Buenos Aires.
Status: Proposed.

This announcement appears for the purpose of record only.

NEW ISSUES — August 16, 1960

Tuboscope Company

$1,800,000

First Mortgage and Collateral Trust 6% Serial Notes
Due May 15, 1975

5,000 Shares
Prior Preferred 6% Stock
$100 Par Value

These Securities were placed privately with institutional investors through the undersigned, and have not been and are not being offered to the public.

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JOURNAL PIPELINE MAPS
For Reference and Display

New Pipeline Maps
Size 36x48

1. **Crude Oil and Products Pipelines**
—Shows existing and proposed lines in the U. S. and Canada.
—Gives operators and line size.
—Lists principal systems with location of home offices.
—Shows refinery locations.

2. **Natural Gas Pipelines**
Routes of existing and proposed lines in the U. S. and Canada.
—Gives operators and line sizes.
—Lists principal systems with location of home offices.
—Shows compressor station locations.

Price $2.00 each

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The Oil and Gas Journal
Box 1260 — Tulsa, Oklahoma

FAST, SAFE PIPELINE REPAIRS WITH NEW SMITH SPLIT-COUPLING

Completed Installation

Completed Installation (When welding is Specified)

The Smith Split-Coupling can be used as coupling, repair clamp or split sleeve.

Easy installation—Place halves around pipe. Tighten side bolts.

Permits welding while pumping.

Available in standard pipe sizes.

Extra lengths and special dimensions on application.

THE PIPE LINE DEVELOPMENT CO.

5700 Detroit Avenue · Cleveland 2, Ohio

SMALL RIG INDICATOR

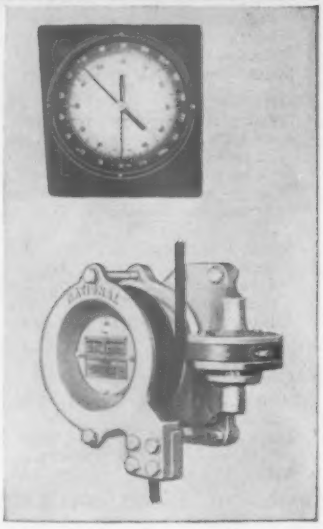
The New

MARTIN-DECKER

TYPE "G"

for the Small Drilling Rig Workover or Production Hoist

The new Type "G" Weight Indicator, is a scaled down model of the Martin-Decker Type "D", "E" and "FS" Weight Indicators. It includes the SENSATER permanently mounted in the Deadline Anchor and all other advantages of the larger units, yet it is light and small enough for the stringent requirements of portable rigs.



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MARTIN-DECKER CORPORATION
3431 CHERRY AVENUE, LONG BEACH 7, CALIF.

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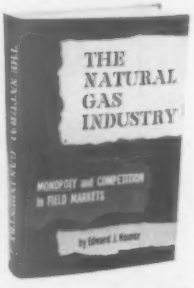

The Natural Gas Industry

Monopoly and Competition in Field Markets

BY EDWARD J. NEUNER

Is there a gas industry monopoly in field markets . . . or isn't there? Is it **really** necessary for prices to be regulated by the federal government?

Here is a detailed, impartial investigation of the most controversial public economic policy of our times . . . the requisite factual and analytical foundation upon which a rational decision could be made . . . for all who are concerned with the details of natural gas production and its regulation, control, and resulting price to customers.

THE OIL AND GAS JOURNAL
Reader Service Department
P. O. Box 1260 Tulsa, Okla.

Please send _____ copies of THE NATURAL GAS INDUSTRY, by Edward J. Neuner:
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This week's SHOWCASE features . . .

New hydraulic flange spreader

. . . on the market consists of a hydraulic pump and cylinder that force a wedge between two steel plates which are hinged to the cylinder body. In a typical operation, the Hydrawedge plates are inserted between the flange faces to be separated. When the handle is operated, it causes the unit to apply a smooth yet strong separating force to the flanges without shock or splintering hazards, the maker reports. Since the plates are attached to the body of the unit, there is no ejecting force or tendency of the unit to back out of the slot, the maker says. The unit measures 24 in. long and weighs 22 lb. It provides a 60-ton spreading force. Attachments adapt it for pulling wheels and pressing on bearings. Source: **Hydra-Wedge, 208 W. Walnut Ave., El Segundo, Calif.**

Detector tells if bearing too hot

. . . on pumps and motors at remote pipeline stations. The Model 313 detector is a dual-element type which measures the same temperature at two different locations or permits indication and recording simultaneously. Comprising two concentric elements, the instrument is, in effect, two detectors in one housing. Made with a 5/16-in. diameter, the unit comes in lengths up to 10 ft. The holder is spring-loaded to press the tip of the detector against surfaces being measured. Source: **Instrument Div., T. A. Edison Industries, McGraw-Edison Co., West Orange, N. J.**

Electronic-controlled metering

. . . of chemicals is available now. A wide range of the maker's Pulsafeeder metering pumps capable of handling corrosive and noncorrosive liquid chemicals is available with electronic controls. Three types of controls are offered: a combination electropneumatic which uses air for power only, an all-electric, and an electrohydraulic type.

The pumps are a positive-displacement type. A reciprocating piston within the pump forces oil to move a diaphragm back and forth. The back stroke takes liquid chemical into the reagent head through suction check valves. On the forward stroke, liquid is forced through the discharge valves. The diaphragm isolates the chemical being pumped to an area within the reagent head plate and check valve. Source: **Process Equipment Div., Lapp Insulator Co., 116 Hall, LeRoy, N. Y.**

Want more facts about equipment or copies of product literature described in this issue?

Send this **Showcase Coupon**

to manufacturer at address shown in bold type after each item.

Product name, Model no., literature title or number: .....

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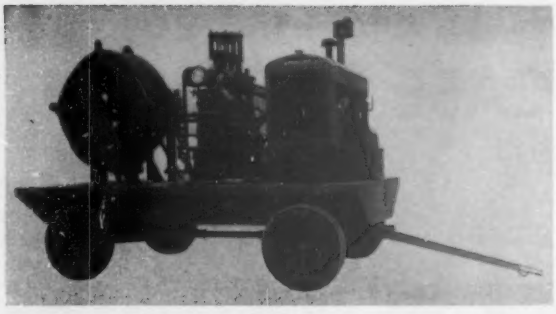
Described in OIL AND GAS JOURNAL - Issue of **August 29, 1960**

NAME..... TITLE.....

COMPANY.....

ADDRESS.....

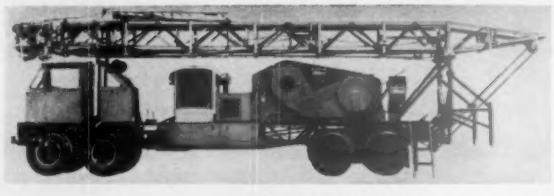
CITY..... STATE.....



Tubes cleaned without solvents

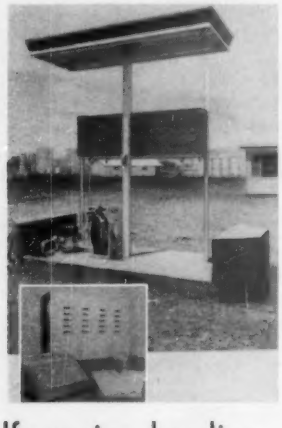
. . . with this newest product for hydraulic cleaning of heat-exchanger tube bundles and other equipment. The portable Hyjet unit cleans with a stream of water flowing through a nozzle at pressures up to 4,000 psi. or higher. You can control the jet stream easily and need not be a skilled operator to use the equipment, according to the maker.

A safety control automatically shuts off the unit when the nozzle is unmanned. Besides tube bundles, the unit can be used for decoking, slag cleaning, paint and scale removal, and hydrostatic testing. It can be powered by a variety of power sources and comes in both portable and skid-mounted models. Source: **Power Specialty Co., Box 6365, Houston 6.**



Rig rated at 120,000 lb. capacity

. . . handles 8,000 ft. of 2½-in. upset tubing. The Winchmobile Junior has a special crown block that makes the blocks fall with the flat side toward the mast. Other features include: guyline winches, automatically raised racking platform, air-tube disk clutches on all drives, a line-raised 66-ft. angle steel mast, two-point base, outriggers, and fast-lowering support jacks. The unit measures 42 ft. long and 11 ft. 6 in. high. Source: **Wilson Mfg. Co., Inc., Box 1031, Wichita Falls, Tex.**



Self-service loading

. . . fueling is possible with a new system on the market, called the Accounta/Key system. It electrically transmits liquid-withdrawal data directly into any type of accounting system. Truckers can fuel their equipment at any time, day or night. The driver simply inserts his key into his assigned slot and turns on the system to load his fuel tanks. Turning the key starts the pump. A meter records the personal loading data at two points, the fueling site and a panel in a locked station house.

The system permits customer fueling records to be read directly from the panel for billing. Source: **Granberg Corp., 67 Hollis, Oakland, Calif.**

●

Portable filters

. . . on wheels are available in a new line, called SD (sealed disk) and Pak filters. You can obtain the portable filters in sizes from small pilot sizes to large production models. Capacities range from 2 to 600 g.p.m. All filters can be used with conventional pumps and motors. According to the maker, the filters are highly versatile and fit most liquid-processing applications.

Features include Type 316 stainless-steel construction and a simplified piping arrangement. Source: **Alsop Engineering Corp., Milldale, Conn.**

●

Casing roller

. . . to restore casing to its normal internal diameter and roundness has been developed that differs from other types in that it does not contain small parts to be worn, broken, or lost in a well, according to the maker. Large ball bearings running in deep grooves in the mandrel and tapered nose hold all moving parts in place. As the tool is forced into and rotated inside collapsed, buckled, or dented casing, eccentrics force the nose cone and rollers outward against the casing walls, exerting lateral pressure on the casing to restore it to normal inside diameter. Both the mandrel and all rollers are case-hardened to resist wear.

Essentially the casing roller consists of an eccentric mandrel upon which are mounted the series of rollers and tapered nose cone. A threaded box type of connection on the upper end of the mandrel joins it to the drill pipe. Interchangeable rollers can be used on each mandrel size. Source: **Bowen Itco, Inc., Box 4587, Houston 13.**

●

Liquid hydrocyclone

. . . features extremely fine particle selectivity as it separates salt, oxides, and sand from power oil on hydraulic bottom-hole pumping systems, the maker claims. The unit is expected to prove valuable on fluid systems where objectionable solids need to be separated fast and efficiently without down time for solids removal, bypassing, and backwashing. Source: **Taylor Oil Tools, Box 4687, Oklahoma City 9.**

SHOWCASE . . .

New Literature

Air-tube disk clutches, brakes

. . . publication has just been printed in a 32-page form. It contains complete specification data and photographs covering various types of applications. The catalog includes suggested clutch and brake arrangements to help in design or unusual applications. Source: **Wichita Clutch Co., Wichita Falls, Tex.**

Industrial ventilating

. . . equipment for use in corrosive atmospheres is shown in a new bulletin just published. It gives details on glass-fiber duct fans and on blower or roof ventilators to offset the effects of acids, alkalies, and other corrosive elements. Source: **Hartzell Propeller Fan Co., Piqua, Ohio.**

Tube-fittings

. . . catalog is indexed for fast reference to each fitting. Specification tables are accompanied by cutaway drawings with all product dimensions letter-keyed to specifications and dimensions in the table. The catalog, which lies flat when opened, carries all tables in large type with clear-cut illustrations. Source: **Lenz Co., 3301 Klepinger Rd., Dayton 1, Ohio.**

Titanium facts

. . . is the title of technical Bulletin 100 which lists various types of titanium and titanium alloys with their commercial and military-code designations, metallurgical properties, and other technical data. The publication discusses methods of welding titanium by the shielded-arc, spot, seam, and flash methods. Source: **Nooter Corp., 1400 S. 3rd St., St. Louis 66.**

Silent check valves

. . . analyze pressure losses, as described in new four-page Bulletin 659 now available. Tests analyze pressure losses for globe-type valves in diameters ranging from 4 through 18 in. Source: **Williams Gauge Co., Inc., Two Gateway Center, Pittsburgh 22.**

Pressure-control

. . . pilot bulletin spotlights the type E-1 unit and offers operational data, features, applications, and installation instructions. A large cutaway drawing of the pressure-control pilot is contained in Bulletin 160. Accompanying the cutaway are numbers which correspond to a listing of the unit's parts. Source: **Meria Tool Corp., P. O. Box 2576, Dallas 21.**

Cast-alloys

. . . reference chart contains 55 of the more widely used cast alloys in the carbon, low-alloy, and stainless groups, along with nickel and monel. In addition to composition and physical-property information, the chart presents design applications of each steel alloy. Source: **Lebanon Steel Foundry, 129 Lehman St., Lebanon, Pa.**

Arc-welding guide

. . . now available, is a newly revised 6½ by 3¾-in. booklet. It gives information on essentials for proper welding procedures, examples of good and bad welds, welding positions, operator qualifications, welding metals, etc. Source: **Hobart Brothers Co., Troy, Ohio.**

Microcrystalline

. . . waxes booklet lists specifications for the various waxes: hard, plastic, emulsifiable, and synthetic. It describes characteristics and advantages of those waxes as used in sealing compounds and other products. Interspersed throughout the 16 pages are photographs, photomicrographs, drawings, charts, tables, and diagrams. Source: **Bareco Wax Co., 917 Enterprise Bldg., Tulsa 3.**

Fire-control chart

. . . in Spanish now available, is an updated revision of an earlier chart which was widely used in training programs. The 8½ by 11-in. chart includes ratings based on new UL standards. It gives data on Class A, B, and C fires and the latest extinguishers suitable or unsuitable for each class. Source: **Walter Kidde & Co., Inc., 675 Main St., Belleville 9, N. J.**

Lubricating equipment

. . . Catalog X-135 lists a variety of widely used products for handling many oiling jobs. Drawings, specification tables, and descriptive paragraphs round out the data on oil cups, oiling systems, dispensers, valves and flow indicators, oil gages, and chain oilers. Source: **Oil-Rite Corp., 2342 Waldo Blvd., Manitowoc, Wis.**

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MACK
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▶▶▶ Equipment Men Notes

Hellmuth (Dick) Strauss named

Hellmuth Strauss

. . . vice president and general manager of Walworth Co., filling the spot vacated by the resignation of Harold Brown. Strauss will be returning to the company he served as an executive and board member for more than 25 years before he left 3 years ago.

Seven reassignments announced

. . . by Houston Oil Field Material Co., Inc.

H. H. Hughes is now central division manager and manager of the Houston district. Promoted to newly created positions of technical advisers for customer relations are T. C. Smith and Linn Galeener.

Frank Singletary is now director of cutting and fishing and directional drilling. H. L. Lodge, former city salesman for the supply operation, has been moved to city sales in Houston for cutting and fishing. Gustav Schmidt, previously with machinery sales, is now in city sales, supply. Eddie Zublin, export department, has been shifted to city sales for directional drilling. All seven are headquartered in Houston.

Cummins Sales & Service splits

. . . its operations into two divisions; elects a vice president in charge of marine sales; and makes new management assignments for three officers, reports President L. J. Troutz. The organization, a distributor for Cummins diesel engines, soon will occupy new headquarters at Arlington, Tex.

H. B. Burr, Jr. has been named vice president of sales; J. B. Siegrist, vice president—southern division; and H. H. Hope, vice president—northern division. All are located at the home office in Fort Worth. A. C. Zugar is the new vice president in charge of marine sales.

Alignment into two divisions was effected to provide closer contact with customers and field operations, from a standpoint of both sales and service, Troutz explained.

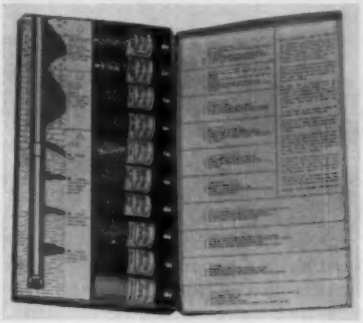
Other duty assignments announced include: G. E. Ball, from manager of Fort Worth's service department to director of service division; W. W. Scott, from general service manager, Fort Worth, to production manager; W. R. Bowman, from division manager, Oklahoma City, to technical service manager, Fort Worth; Emmert W. Wright, from manager service development, Fort Worth, to director of operations; and J. E. Kuykendall, from assistant purchasing agent, Fort Worth, to materials manager.

Edwin F. Nelson rejoins UOP

. . . as a consultant for process sales and engineering, according to M. D. Gilchrist, senior vice president. A vice president of Universal Oil Products Co. from 1945 to 1952, Nelson left the firm to become president of Lake Superior Refining Co. He first joined UOP in 1926.

Bucyrus-Erie Co. transfers

. . . its drill sales operations from Richmond, Ind., to the company's main offices at South Milwaukee, Wis. Machine inquiries, orders, and requests for sales information on cable tool and rotary drills or oil-well-servicing rigs should be directed to the company at the main office.



New lost-circulation kit

. . . developed by Magnet Cove Barium Corp., is designed to explain functioning of lost-circulation materials in drilling operations, according to I. W. Hoskins, Magcobar's vice president—marketing. The kit has been made available to help drilling-mud purchasers who are confused by the many lost-circulation materials marketed today under more than 100 different trade names.

Housed in a special box, the kit consists of samples of 10 basic lost-circulation materials, a graphic illustration of a geologic subsurface cross-section, a listing of the product applications, and directions for correlating the product uses with various types of lost-circulation zones encountered in drilling.

J&L opens new supply store

. . . at Fort St. John, B. C., according to Rainey Elliott, president of Jones & Laughlin Supply Division. R. C. Dean has been appointed store manager, and W. B. McClelland, salesman.

The facility is included within J&L's western district, Canadian region, with district headquarters at Edmonton and regional headquarters at Calgary.

Robert E. Quinn assumes post

. . . as district manager of Axelson's hydraulic department, California area, locating at the company plant in Los Angeles. Prior to his appointment, he was service manager for Axelson Division of U. S. Industries, Inc.

E. C. Swain, factory representative formerly headquartered in Oklahoma City, has been transferred to the company's office and warehouse in Odessa, Tex. in the same capacity.

Hugh W. Baird is board member

H. W. Baird

. . . of Midwest Piping Co., Inc., St. Louis, announces A. G. Stoughton, board chairman. Baird is president and a board member of Standard Pipe Protection, Inc., pipe-coating and wrapping firm of which he was one of the founders in 1948. He was formerly manager of pipeline sales for National Tube Division of U. S. Steel Corp.

Continental-Emsco announces

. . . several promotions and transfers. New store manager at Morgan City, La., is Hurst D. Reynolds, former field salesman there. Billie Ray McKinney, field salesman at Jena, La., has been promoted to store manager at Citronelle, Ala. Robert P. Pope is the new store manager at Rock Springs, Wyo., moving from field salesman at Williston, N. D.

Thomas A. Mann and Clifford W. Ligon, former field salesmen, have been promoted to division sucker-rod specialists. Mann is located in Oklahoma City; Ligon is in Houston. Murry D. Seiley, service representative at Billings, Mont., is now a district service manager at Casper, Wyo.

Store Manager Robert L. Collier, Jr., has been transferred from Rock Springs, Wyo., to Casper. James C. Ellis, store manager, is now at Lake

Charles, La., being transferred from Morgan City, La. Nixon J. Barker, D&B specialist, has been moved from Rangely, Colo., to Sterling, Colo. Sanford H. Shocklee, district manager, has moved his offices from El Dorado, Ark., to Shreveport in the same district.

Harvey B. Cox, Jr. is appointed

. . . a sales engineer in Cooper - Bessemer Corp.'s Houston branch office, reports George Edick, domestic sales manager. Cox, formerly with Clark Bros. Co. in Houston, will report to E. P. Martin.

H. B. Cox, Jr.

Offices to be consolidated

. . .when Atlas Bradford Co. and its operating divisions, Atlas Pipe, Inc. and Bradford Supply Co. move into a new building in Houston. Bradford headquarters will be transferred from Bradford, Pa.

Personnel involved in the move include Donald W. Mackie, president of Atlas Bradford; J. D. Hayes, vice president and treasurer; and Tom Blauser, vice president of purchases of Bradford Supply.

The organizations will occupy the entire first floor, 12,000 square feet, in a building nearing completion at the southwest corner of Kipling Street and Yoakum Boulevard.

Ken Corp. appoints distributors

. . . for its oil-base drilling and packing fluids. Forafluid in Paris, France, will represent the corporation in French communities, Spain, Greece, and other countries in the Mediterranean area, including French companies operating in Libya. Forafluid is managed by Gerard Landriot.

Macridge in Bierut, Lebanon, will represent Ken in the Middle East, Egypt, and in Libya, except for the French operators there. C. B. (Connie) Ridgeway is Macridge's manager.

Mid-States Pipe & Supply buys

. . . Champlin Oil & Refining Co.'s Wardner gasoline plant located near Bishop, Tex. The high-pressure plant was originally designed to process 150 M.M.c.f. of gas per day, and just recently was shut down.

H. A. Horwitz, president of the Tulsa firm, advises that plans are being made to dismantle plant equipment for sale to oil, gas, and chemical industries.

Oil Well Supply Division names

. . . field representatives at Los Angeles, Pettus, Tex., and Shreveport.

Edward W. Metters, manager of the division's Long Beach, Calif., store, and Curtis T. Deehr, field representative there, will move to fill posts in Los Angeles. Albert L. Jacob, an 11-year company veteran, is the new representative at Pettus. Assuming similar duties at Shreveport is John B. Fowler.

R. L. Morris takes over

. . . as regional field development engineer at Houston for Schlumberger Well Surveying Corp. He moves from Shreveport where he had been manager of the corporation's North Louisiana division. Morris has been with Schlumberger for 23 years.

R. L. Morris

At the same time it was announced that Louis L. Raymer, special services engineer in the Houston district, had been transferred to the headquarters staff. His assignment includes study of logging problems, consultation with customers, and preparation of technical information for publication.

M. Stafford Thompson is named

. . . director of new product development for the market - development department of Celanese Polymer Co., a division of Celanese Corp. of America. He will be responsible for merchandising programs and field contacts in the commercial development of new basic polymers and plastic molding compounds.

Thompson joined Hercules Powder Co. in 1947 and spent 7 years in research, pilot plant, product development, and sales, primarily in the field of plastics. In 1954 he joined Naugatuck Chemical Division of U. S. Rubber Co. where he managed product development and sales service for Kralastic plastic.

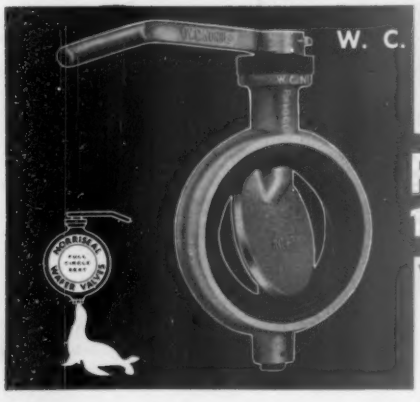
Coynco Products, Inc. acquired

. . . by Yuba Consolidated Industries, Inc., according to John L. McGara, president of the San Francisco firm. Coynco's Tulsa plant will be expanded and developed into a manufacturing center for Yuba's shell and tube and air-cooled heat exchangers. The operation will be known as Yuba-Tulsa Corp., a subsidiary of Yuba Consolidated Industries, Inc.

Bovaird Supply Co. is distributor

. . . of Gardner - Denver mud pumps and other petroleum equipment, according to Davis D. Bovaird and Gifford V. Leece, presidents of the two companies. The Tulsa supply company now is authorized to distribute Gardner-Denver petroleum equipment in all of Bovaird's stores in Oklahoma, Kansas, Texas, New Mexico, Louisiana, and Illinois.

Bovaird, engaged in the petroleum-supply business since 1871, currently operates 20 stores in addition to eight sales offices.



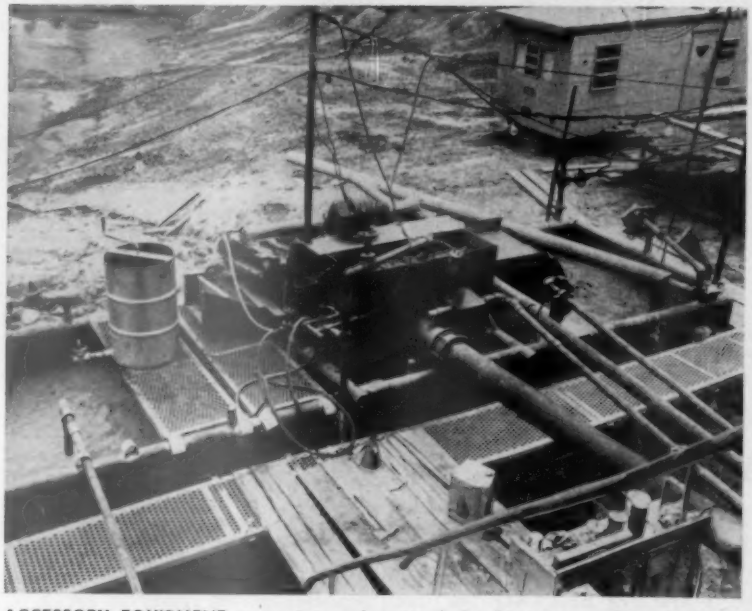
Bay area slated for appraisal test

AN AREA of over 4,000 acres—inundated when the levees collapsed in 1937—is scheduled for drilling in California. In the bay area near San Francisco, McCulloch Oil Corp. of California is grading location for McCulloch 1 Frank Tract.

The operator will drill on a farmout from Kern County Land Co. of California.

From the onshore location, the test will go horizontally 3,000 ft. to a target that will bottom at a true vertical depth of approximately 5,060 ft. under the water. The total depth of the well is expected to be 6,150 ft. Targets sought include the Nortonville, Domengine, Ione, Capay, and Midland. Legal discription is 13-2n-3e, 100 ft. south and 2,000 ft. west of the northeast corner, Contra Costa County, California.

Auxiliary equipment plays big drilling role



ACCESSORY EQUIPMENT is an integral part of the big rigs working in North America. Above is Link-Belt shale shaker made by Link-Belt Co., Chicago. Another piece of equipment on this modern rig is . . .

DESANDER IN ACTION made by Demco, Drilling Equipment Manufacturing Co., Oklahoma City, on H & S Drilling Co. of Tulsa Rig 2. Operation is a 10,000-ft. hole in Calhoun area of North Louisiana.

Giant mud pump on moderate rig

HERE'S ONE operator who believes in bigger mud pumps. Tine Gaiser, Bakersfield, Calif., contractor, has put an Emsco DA-700 into use with his Emsco GB-500 rig. According to the manufacturer, this equipment addition makes the contractor the owner of the largest pump on this size rig in the United States.

A pump of this type normally would be used for a rig operating at 10,000 to 14,000-ft. levels. Tine Gaiser's rig normally operates in the 5,000 to 9,000-ft. range.

The unit on which the new pump is presently working is in the Carrizo Plains area where Gaiser's crews are making hole below 7,400 ft. at the R. K. Cross 52-34 Chimeneas-Arnold, which is scheduled for a 9,000-ft. test.

Active Rigs*

	Rotary	Cable	Total†
Alabama	5	0	5
Alaska	7	0	7
Arizona	1	1	2
Arkansas, South	22	0	22
California, Offshore	6	0	6
Inland	116	1	117
Colo., excl. Four Corners	23	3	26
Four Corners	13	2	15
Florida	2	0	2
Georgia	3	0	3
Idaho	0	0	0
Illinois	51	8	59
Indiana	23	40	63
Iowa	1	0	1
Kansas	77	4	81
Kentucky, Western	3	41	44
Louisiana, North	100	0	100
South Inland	224	0	224
Offshore	65	0	65
Mississippi	62	0	62
Missouri	0	1	1
Nebraska, East	2	0	2
West	21	0	21
Nevada	6	1	7
New Mexico, East	81	28	109
West	35	9	44
North Dakota	17	0	17
Oklahoma Panhandle	24	9	33
Ohio	6	119	125
Oregon	1	0	1
South Dakota	0	1	1
Texas, Offshore	1	0	1
East	55	0	55
Upper Gulf Coast	95	0	95
North	91	1	92
Panhandle	48	7	55
Corpus Christi	134	0	134
San Antonio	42	4	46
West	196	17	213
West Central	86	16	102
Utah, North	13	1	14
South	17	0	17
Washington	1	0	1
West Virginia	5	207	212
Wyoming	57	5	62
Reported U. S. total	**1,838**	**526**	**2,364**

*Report to AAODC by the International Oil Scouts Association. †As of August 12, 1960. Not reported: Michigan, Montana, Oklahoma—except Panhandle.

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"Basis for location" seen as misleading

True credit for discovery of new oil and gas fields often must wait for later development

BY FRANK J. GARDNER

A FEW YEARS AGO, a hilarious book was published under the title, "How to Lie with Statistics." At the last national meeting of the AAPG, Geologist Tom Culbertson, of Union Oil Co. of California, presented a paper that was amazingly parallel in theme.

Culbertson was concerned about the industry's misconstruing the statistical tables contained in the AAPG's annual report on exploratory drilling. His thesis was that to reflect pure truth, these tables (or the one portion of them concerned with "basis for location") should rate a new look every few years. He quoted two excerpts from trade journals that typified such misinterpretations.

"Results prove that geophysical exploration reduces exploratory drilling risk by two-thirds," and . . . "Either the figures need to be corrected, or the oil industry should stop using geologists in areas where geophysical information is available."

To illustrate his point, Culbertson used the tables shown here. On the left side are the old records, still standing, as reported in AAPG bulletins. On the right is shown later dope that would change the whole picture as far as credit for discovery is concerned.

Jo-Mill field in West Texas, for example, was first reported as a seismic discovery. "However," Culbertson says, "a geologist had predicted a subsurface regional sand trend which turned out to be a success. And the prediction of a seismic structure was a failure." In the case of Brahaney field, a similar situation developed. Originally sold as a seismic prospect, the drill failed to confirm the seismic picture; dependable sources credit geologic interpretation of a stratigraphic trap. The same thing applied to discovery of Arthur and Big Spring fields.

Pecos County's Sheffield field shows the need for thoroughness on the same theme. Officially recorded as a "subsurface and seismic" strike, additional information showed that the structure had been identified as a surface uplift detected by aerial photos. the core drill, and surface geology.

"There are literally hundreds of such misleading and erroneous statements in our records," Culbertson declared.

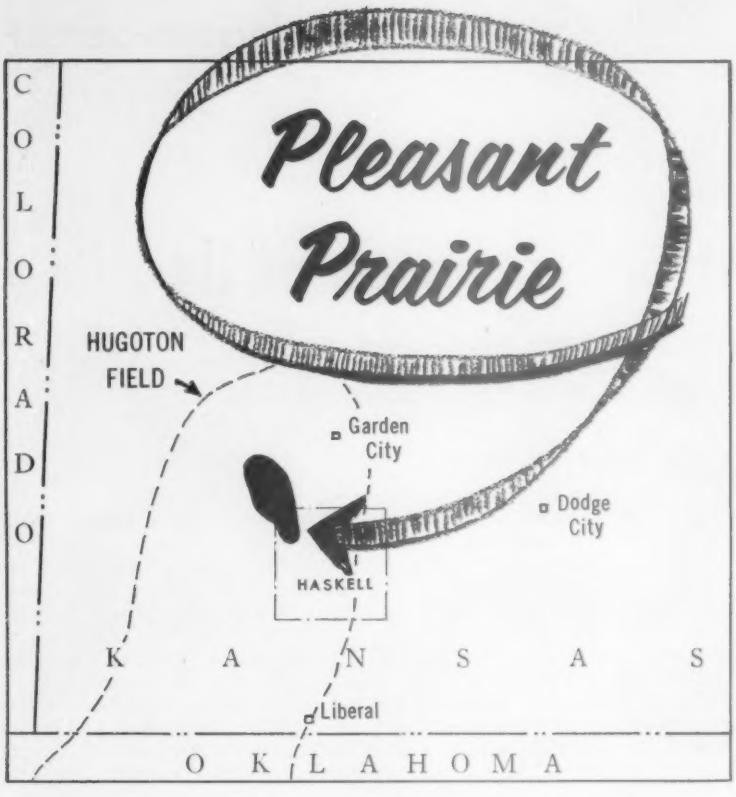
As one remedy to the situation, he suggested a program of case histories on future discoveries. Studies of newly discovered oil and gas fields would be published annually under such a program. It would be a cooperative effort of all operators involved. As drilling turned up the true picture of structural and stratigraphic conditions, a true pattern of discovery credit would emerge.

Culbertson saw the need for action! Not only did he point to a weakness, but he worked to eliminate it. He went before the AAPG's Committee on Statistics of Exploratory Drilling, moved that the "Basis for Location" column be removed from the committee's annual report; then approached the Business Committee with a motion to establish a "Case History Committee on Oil and Gas Discoveries." Both motions were passed and are now being studied by the executive committee of the AAPG.

Come what may, the damage has been done; the errors are in the record. Which proves once more that you can't always believe what you read.

TYPICAL EXAMPLES
(From A.A.P.G. Bulletins)

Old Records		New Information	
Field Name	Basis For Loc.	Basis for Location	Results
JO-MILL	Seis.	Sub. Strat. (Prod. sand trend) Seis. Struct.	Success Failure
BRAHANEY	Seis.	Sub. Strat. (Prod. reef-like trend) Seis. Struct.	Success Failure
ARTHUR	Unk.	Sub. Strat. (Prod. sand trend) Seis. Reef	Success Failure
BIG SPRING	Seis.	Sub. Strat. (Prod. dol. trend) Seis. Struct.	Success Failure
SHEFFIELD	Sub. Seis.	Surf. Struct. (Photos, core drill) Seis. No Struct.	Success Failure
BAKKE	Sub. Seis.	Sub. Struct. (Shallow & deep) Seis. No Struct.	Success Failure



BY FRANK O. BENNETT
Division Geologist
Helmerich & Payne, Inc.
Tulsa

A MISSISSIPPIAN OIL FIELD in northwestern Haskell County in Southwest Kansas has given this corner of the Mid-Continent region one of its most prolific deep producers. Fig. 1.

In Kansas' Hugoton the operator with gas-held acreage holds the whip hand

UNDOUBTEDLY the most notable development in Kansas, during the past decade, is the emergence of western Kansas from comparative obscurity to recognition as a budding major oil province.

The rousing successes of the fifties featured unusually high discovery ratios, substantial to prolific reserves, excellent allowables, fast payout and multipay targets. These factors will provide the bright lure for exploration and development during the 1960's and for years to come. At this stage of development, the area is comparable to the Central Kansas-Barton arch sector in the early 1930's.

Large area. Western Kansas comprises roughly the western one-third of the state, stretching from the Barton arch to the Colorado line, and from Nebraska to the Oklahoma line. It is divisible into at least four separate areas of interest and geological characteristics: (1) northwestern Kansas, (2) Hugoton gas field, (3) southwestern Kansas and (4) the eastern area lying between the Hugoton gas filed and the Barton arch. Eleven formations have been found productive of oil or gas—more, if individual formations within the Chase group, etc., are listed—and include the Chase group, Council Grove, Topeka, Toronto, Lansing-Kansas City, Marmaton, Cherokee, Morrow, Chester, St. Genevieve, and St. Louis formations.

Hugoton embayment. Tectonically, western Kansas is known as the Hugoton embayment, the northwestern projection of the Anadarko basin of Oklahoma. Hugoton gas field, the largest dry gas field in the world, occupies some 4,000 sq. miles of the embayment. Shallow gas production is obtained from the Herington, Krider, Winfield, Towanda, and Ft. Riley dolomite limestones of Permian age (Chase group) at depths ranging from 2,300-2,750 ft. The middle member, the Winfield limestone, has been consistently used as the marker bed and exhibits approximately 1,000 ft. of east dip across the 51-mile-wide field, from a +1,100 to a +100-ft. datum. This regional east dip is interrupted by nosings or by closed structures with as much as 60 to 80 ft. of west dip.

Deep Development

In contrast, the Mississippian beds dip rather sharply to the southwest and southeast from the flanks of the Hugoton embayment, attaining a subsea datum of approximately 3,850 ft. in Meade County, the deepest part of the embayment. This represents 2,200 ft. of dip from a subsea of 1,650 ft. in the Nunn pool at the northeast edge of the Hugoton field. Before 1950, the Mississippian rocks underlying the interior Hugoton field were largely an unknown quantity and only a handful of tests, all dry holes, had penetrated the Pennsylvanian. Nunn

field (Mississippian and Marmaton) had been discovered in 1938 and a few miles northeast, out of the gas area, Shallow Water field (Mississippian and Morrow) in 1934.

Much of the deeper development in the Hugoton gas field lies in the area comprising Townships 26s through 30s and Ranges 33w through 35w. Within this 540-sq.-mile rectangle are the Pleasant Prairie, Ivanhoe, Beyer (abandoned), Pollyanna, Eubank, East Eubank, Koenig, Hick, Hopkins, and Satanta pools. The structural configuration of the Winfield (Permian) through this portion of the Hugoton embayment, shows a remarkable conformity to the Mississippian surface.

The reliability of the shallow Winfield marker, in reflecting deeper structures and production, is impressively demonstrated by the fact that the first 10 well-defined Winfield anomalies in the general area to be tested by the drill proved to be productive in formations below the Permian gas pay.

First Pre-Penn pool. Pleasant Prairie, the first Pre-Pennsylvanian pool in the area described above, was discovered by the completion of Helmerich & Payne, Inc., (White Eagle Oil Co.) 0-16 Jones, SW SE NW 4-27s-34w, Haskell County on May 3, 1954, at a total depth of 5,101 ft. It was finaled for a pumping potential of 167 barrels of oil per day from a porous, oolitic zone at 5,081-85 ft. in the top 4 ft. of the St. Louis member of the Mississippian. Gravity of the oil was 35°.

The confirmation well, Helmerich & Payne, Inc., 0-17 Jones, NE NE SW 9-27s-34w, was drilled to a total depth of 6,262 ft. in the Arbuckle dolomite, topped at 5,992 ft. The Mississippian rocks were 763 ft. thick, underlain by 110 ft. of Kinderhook, 157 ft. of Viola and 50 ft. of Simpson. The well was plugged back for completion in a St. Louis zone at 5,096-5,105 ft., 60 ft. below the top of the formation. This oolitic pay zone has been present in every well drilled in the field to date.

Early in the pool's development, the Mississippian zones of porosity and staining were lettered for convenient identification, a system adopted by most of the area operators. The "A" zone designates any porous development in the relatively thin St. Genevieve section; the "B" zone occurs in the top 10 to 20 ft. of the St. Louis (producing zone in the discovery well) and the "C" zone marks the major producing zone as first identified in the 0-17 Jones. Two other oolitic zones have been found productive, making a total of at least four separate zones with an aggregate net pay thickness of approximately 50 ft. in several wells.

"The first 10 well-defined Winfield anomalies in the general area to be tested by the drill proved to be productive in formations below the Permian gas pay."

Approximately 30 ft. below the base of the "C" zone is an ever-present 5 to 6 ft. bed of light gray, bentonitic shale which has been designated as the "D" zone. It has such singularly consistent electric-log characteristics that it is used as the marker bed to accurately correlate overlying pay zones.

After Pleasant Prairie. The successful, albeit modest, launching of the Pleasant Prairie field logically led to the drilling of other Winfield anomalis in the area by Helmerich & Payne, Inc. The completion of the White 0-4, NE SW SW 13-26s-35w, Kearny County, 5 miles northwest of Pleasant Prairie, opened Southside pool in May 1956. Northwest Pleasant Prairie pool, midway between the Pleasant Prairie and Southside pools, was discovered early in January 1957, by Helmerich & Payne's 1-30 U.S.A., NE NE SW, Finney County.

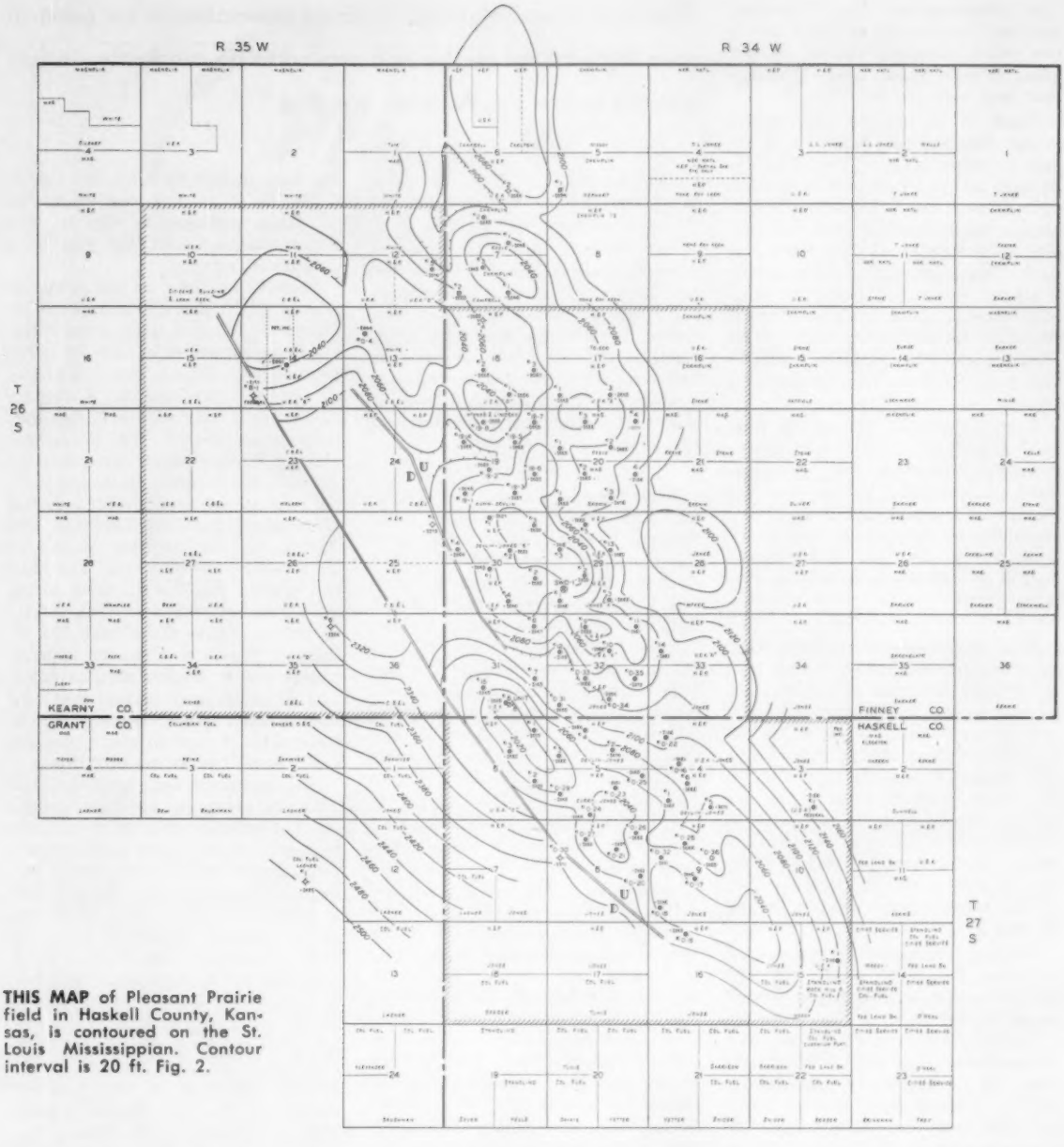
These three pools have since been merged by development into Pleasant Prairie field, which currently numbers 82 producing wells, 1 abandoned well, 5 dry holes and several active tests. Sixty-one wells are owned by Helmerich & Payne, Inc., eight by McKnab & Lindsay, eight by Mobil Oil Co. and five by Champlin Oil & Refining Co. Eighty-one of the wells, including seven dual completions in the Morrow and Mississippian, produce from the St. Louis (Mississippian) oolitic zones. The well in 14-26s-35w is producing from the Lansing after depletion of Mississippian production. The limits of the field have not been defined, but a structural drop and thinning of zones to the east and southeast are slowing further development in that direction.

Structure. The structure, on the top of the Mississippian, is an elongate northwest-southeast trending anticline or anticlinal nosing, 7 miles long and 2½ miles wide with at least 95 ft. of producing closure. The top closing contour in 7-26s-34w, at the north edge of the pool, is virtually flat with that in Sec. 9 and 16-27s-34w on the south side. However, in a distance of 5½ miles to the southeast, from the producing well in 16-27s-34w to a dry hole drilled by Shell Oil Co. in C NE SW 1-28s-34w, the dip on the St. Louis amounts to 496 ft. The abrupt steepening of dip may be a product of faulting.

Probable faulting, of late Mississippian or early Morrowan origin, is indicated on the west flank of the Pleasant Prairie structure by two dry holes; Helmerich & Payne, Inc. 1 Citizens, C NE NE 25-26s-35w, Kearny County, and Helmerich & Payne, Inc., 0-30 Jones, C SW NW 8-27s-34w, Haskell County. Both were low on the Winfield to offset producing wells, 15 and 46 ft. respectively, and loss of structure gradually increased with depth. On the Morrow shale, the tests were 60 and 92 ft. low. The Morrow section was 204 ft. thick in the 1 Citizens, as compared with 105 ft. in the southeast offset and 231 ft. thick in the 0-30 Jones or approximately 119 ft. thicker than expected. The St. Genevieve section was also thicker than usual, placing the St. Louis 210 ft. low in the 1 Citizens and 320 ft. low in the 0-30 Jones.

The described tests are located in a Winfield trough, which is at least 69 ft. lower than the structurally highest Winfield datum in the approximate center of 9-27s-34w. In the Permian beds this Pleasant Prairie trough is associated with a long, narrow regional syncline, which is easily the most prominent such feature in the Hugoton gas field. It enters the field and mappable area in the northwest corner of 23s-37w, Kearny County, continues southeast through the Pleasant Prairie area and then, in a more easterly direction, to the southwest corner of 27s-31w, Haskell County, where it leaves the gas field.

Erosion of the Mississippian rocks on the east or upthrown side of the fault, has removed the St. Genevieve from nine wells in 31-26s-34w and Secs. 5, 6, and 8-27s-34w, immediately adjacent to the fault plane. The St. Genevieve is also missing in the well in the C SW SE of 4-27s-34w and in the Petroleum, Inc., 1 Federal, C SW SE of Sec. 3-27s-34w, both on the east side of the field. Generally, the interval from the top of the Morrow to the St. Louis is greater in these 11 wells than in those where the St. Genevieve is present. A trashy limeshale zone at the base of the Morrow, recognizable in several of the wells, is possibly a reworked St. Genevieve phase.



THIS MAP of Pleasant Prairie field in Haskell County, Kansas, is contoured on the St. Louis Mississippian. Contour interval is 20 ft. Fig. 2.

The "B" and "C" zones in the St. Louis vary from a few feet to a maximum of 20 ft. in thickness. Porosities in these zones range from 3% to 18% and permeabilities from .01 md. to 4,920 md. Vertical and horizontal fracturing occurs throughout the upper part of the St. Louis down to at least the "D" zone and is expected to play no small part in boosting recoverable reserves.

The variance in porosity and permeability, spiced with the unpredictable effect of formation fractures, has created some rather provocative production situations in Helmerich & Payne, Inc.'s wells. The 0-22 Jones, C NW NW 4-27s-34w, the structurally second-lowest well in the field, showed zero permeability in the "B" zone except for 2 ft. of .1 and .3 md. with 2% to 4% porosity; .1 to .3 md. and 4% to 8% porosity in the "C" zone. A drill-stem test of the latter yielded only 15 ft. of drilling mud with no shows. After fracture treatment, the "C" zone swabbed 14 barrels oil per hour and the "B" zone 10 barrels oil per hour.

Next to reach the pay, the 0-23 Jones, SE NW SE 5-27s-34w, encountered an average permeability in the "B" zone of 1,068 md. ranging up to 4,920 md., along with 18% porosity. Acid fracture treatment resulted in a swab test of 50 barrels oil per hour from the "C" zone and 210 barrels oil in 1 hour from the "B" zone, a sparkling performance by any Mid-Continent standard. In the U.S.A. "A" 7, C NE SE of 31-26s-34w, there was no show natural after perforating the "B" zone, but acid treatment of 1,000 gal. resulted in production of 70 barrels oil per hour.

Perhaps the most intriguing test in the entire field is the U.S.A. "A" 8 in the C SW SE 21-26s-34w, which, together with its twin well the U.S.A. "A" 8 Unit, is the highest well in the pool on the St. Louis at a −2,008 ft. datum. Circulation was lost at 5,005 ft., 9 ft. in from the top of the St. Louis and the well "dry drilled" to

a total depth of 5,155 ft. The "A" 8 literally took the bit in its teeth at 5,082 ft and, despite lost circulation and a restraining brake, covered the next 48 ft. in less than 20 minutes. The interval shows on the McCullough radiation log as good porosity from 5,082-5,130 ft. The hole was abandoned after extensive efforts to run casing or restore circulation were unsuccessful. No drilling or lost circulation problems were experienced in the twin well, which cut a normal section of St. Louis.

The U.S.A. 9 in C NE NW 32-26s-34w lost circulation at 5,100 ft., 76 ft. into the St. Louis. Casing was immediatly run to 5,080 ft. and the hole surveyed with a Welex radioactive log. There was no indication of the "C" zone on the log and operator prepared to drill deeper but, when the plug was drilled, the well filled up within 300 ft. of the surface and swabbed 122 barrels oil per hour, natural.

Erratic Morrow. The erratic development of limestones and sandstones in the Morrow section has limited production from that formation to a few wells. The formation is 60-115 ft. thick, except in dry holes, with an average thickness of 80-85 ft. and is predominantly shale, with streaks of shaly lime and sand. The shale is dark gray, light green, dark green, and black, carbonaceous. The limestones are tan, gray, white, or buff, coarsely crystalline, fossiliferous, and slightly glauconitic; the sandstones are shaly, gray to clear, very fine to fine grained, sub-rounded, glauconitic, and calcareously cemented.

No Chester. The Chester series of the Mississippian is not present at Pleasant Prairie, due to regional truncation, and Morrow beds, consequently, rest unconformably upon the St. Genevieve or St. Louis of Meramecian age. The wedge edge is 3 or 4 miles to the south and the Chester thickens rapidly from this point to the southeast into the Anadarko basin where it reaches a thickness of 1,250 ft. or more.

The St. Genevieve, which attains a maximum thickness of 88 ft. in the pool, is a relatively nonporous, light-colored, finely arenaceous limestone, with very small elliptical oolites. At the base of the St. Genevieve is a dark green, waxy to sub-waxy, calcareous, hard shale bed 6-15 ft. in thickness. On the electrical log, this bed unerringly picks the top of underlying St. Louis formation. Cherts in the St. Genevieve are rather sparse, generally milky, vitreous to semiopaque, and yellow, tan and orange in color with pink chert occurring in the shale near the contact with the St. Louis.

The St. Louis limestone, often difficult to distinguish from the St. Genevieve in drilling samples, is gray to buff in color, finely sandy, silty, fossiliferous, and coarsely oolitic. The oolites are usually perfectly round and become quite large near and in the "C" zone. Cherts are gray to pink and are invariably limited to the top 5 ft. or so of the formation.

Pool grows. Developed on 80-acre spacing and sprawling against the backdrop of sand dunes of three counties, Pleasant Prairie pool is well on its way to being one of the largest and most prolific pools to be discovered in Kansas in recent years. Recovery from several of the earlier wells has already exceeded 85,000 bbl. per well and production from the entire field has pushed past the 2,000,000-bbl. mark. Ultimate recoverable reserves from this stratigraphic-structural type reservoir are on the order of 100 bbl. per acre-ft., based on core and electrical log analysis or in excess of 8,000,000 bbl.

Recovery. Individual well recoveries are expected to average out above 100,000 bbl., ranging upward to 400,000 bbl. per well. An original per well cost of opproximately $100,000, to drill and complete, has been lowered through an over-all improvement in mud program and completion practices, as well as a decrease in drill-stem testing and coring.

And now? Pleasant Prairie is only the harbinger of lucrative deep production to be found in the Hugoton gas field, where the operator with gas-held acreage holds the whip hand and controls the destiny of this huge, virtually untapped province.

Sooner drilling spreads out

Oklahoma exploratory and development work spread through several sections of the state. In Noble County, Finston & Rich have a long extension discovery in the northwest part of the county at 1 Seegers, SE SE SW 14-24n-2w.

The well flowed 275 bbl. of oil per day from perforations at 4,428-46 ft. in Mississippi Chat. Nearest production is ¾ mile east at Happy Star field. The well is 1 mile east of West Happy Star gas pool.

Osage County. In northeastern Osage County Elam Oil Co. 1 Mullendore, SW SW SE 16-29n-12e, is an apparent Mississippian discovery. The wildcat tested 10 bbl. of oil in 24 hours.

Near Tulsa in southeastern Osage County, Donald F. Lester 1 Osage, NW SE SE 12-20n-11e, is an indicated Bartlesville Pennsylvanian discovery 1½ miles west of Flat Rock field.

Lincoln County. Powel Briscoe Inc. 1 Breeding, NE NE NE 26-16n-2e, Central Oklahoma discovery, flowed 26,300 M.c.f.d. from perforations in the Cleveland Pennsylvanian sand at 3,914-18 and 3,924-26 ft. Location is 2½ miles south of Northwest Merrick field.

Latimer County. In the Arkoma basin, the third gas well in the deep new area of Morris gas field is indicated at Midwest Oil Corp. et al. 1 Lyons, SE NW SW 9-6n-22e. The well flowed 1 M.M.c.f.d. from 7,100 ft. in the Red Oak sand.

Beaver County. In the Oklahoma Panhandle, Oklahoma Natural Gas Co. has a discovery at 1 Robertson in NE NE SW 16-2n-28eCM, 2 miles northwest of East Holland field. The Morrow Pennsylvanian well flowed up to 6 M.M.c.f.d. with condensate at 7,624-7,708 ft.

An important discovery looms in western Oklahoma's Custer County, just northeast of Thomas townsite and near North Custer City field.

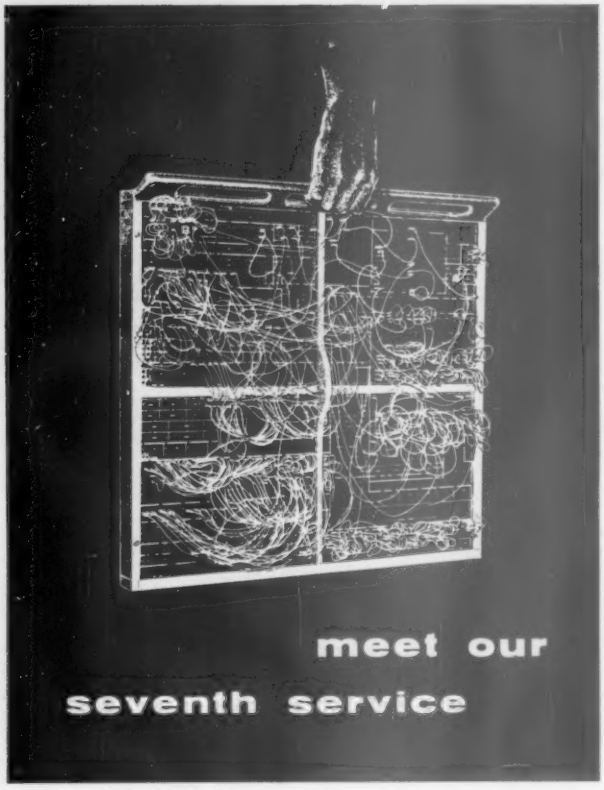
Mobil Oil Co. 1 Horton, SE NW 14-15n-15w, flowed 2,300 M.c.f.d. and 10 bbl. of oil per hour on tests of the Oswego Pennsylvanian at 9,702-93 ft. Recovery on the test was 1,350 ft. of 39°-gravity oil and 590 ft. heavily oil-cut mud.

This possible new field opener would bring first Pennsylvanian production to the county which hasn't had production too long. The Custer City pool discovery, rated as one of the most significant exploratory happenings in recent years, opened the county's first producing area. Its deep (below 14,000 ft.) Hunton Siluro-Devonian production opened a whole new wildcat province for Sooner oil-hunters.

Oil production tapped in Panhandle gas area

There is new oil production in a gas producing sector of Oklahoma Panhandle's Cimarron County. The discovery well is Humble Oil & Refining Co. 1 Wells in NW SE SE 3-1n-9eCM.

Swabbing got 127 bbl. of new oil and 2½ bbl. of water in 12 hours on



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tests in Morrow Pennsylvanian at 4,788-98 ft. Location is inside Southeast Griggs gas field. Nearest oil production is 3½ miles southeast in 24-1n-9eCM.

Wilcox extends toward Texas Gulf Coast

A significant coastward extension of Wilcox production in the Upper Texas Gulf Coast district has been made by a new deep discovery 25 miles northwest of Houston, in Harris County.

The new discovery by Standard Oil Co. of Texas is more than 10 miles southwest of Tomball field, which has the nearest, and the county's only other Wilcox production.

Standard's discovery well, 1 Lenoir M. Josey, Inc., is completed in two zones, both in the Middle Wilcox. The lower zone, perforated at 11,350-70 ft., flowed at the rate of 3 M.M.c.f.d. of wet gas in tests through 10/64-in. choke. Condensate production was at the rate of 25 bbl. per M.M.c.f. of gas.

The upper zone at 11,130-40 ft. flowed 2 M.M.c.f.d. of gas with 18 bbl. of condensate per 1 M.M.c.f., testing through the same-sized choke. Flowing pressures were 5,980 psi. and 3,920 psi., respectively.

Location is only 1½ miles southwest of Cypress field but production there is from the shallower Yegua horizon.

Dual-zone gas discovery boosts Arkoma total

A new dual-zone discovery in Pope County adds another field to the steadily swelling list of gas-productive areas on Northwest Arkansas' side of the Arkoma basin.

Latest discovery is 1½ miles northeast of Scottsville in 4-9n-19w. It is a little over 4 miles northeast of the Dover gas area, nearest production.

Discovery well, Murphy Corp. 1 S. E. Lee Estate, is productive from Barton "B" sand at 1,739-48 ft., and the Hale zone at 1,936-47 ft.

From the former, it flowed 1,098,-380 cu. ft. of gas daily through 24/64-in. choke with pressure of 308 psi. The Hale zone tested 1,186,660 cu. ft. daily through 24/64-in. choke with pressure of 334 psi. Both zones were fractured.

At least two other zones showed for commercial production. One at 1,212-29 ft. tested 1,280 M.c.f.d. The other was in the McGuire sand at 890 ft.

Another northwestern Arkansas wildcat also is completed as a gas well—but a small one. It is classified

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as an extension of the old Cecil gas area, in Sebastian County, but is more than 3 miles west of the nearest production.

This discovery well, Arkansas Louisiana Gas Co. 2 Curtis Wright, flowed 450 M.c.f.d. through ⅜-in. choke from Alma sand at 2,051-82 ft.

Louisiana discovery taps new Wilcox pay

New Wilcox oil production has been found a mile northwest of Tew Lake field in Catahoula Parish, East Louisiana.

There, H. A. Harper has completed his 1 G. S. Beasley making 51 bbl. of 42°-gravity oil daily through 6/64-in. choke from perforated interval at 4,304-5 ft. Flow was with gas-oil ratio of 200 cu. ft. per bbl., and pressure of 385 psi.

Pay is in a slightly deeper zone than either of the two Wilcox producing levels of Tew Lake field. The new discovery is in hole drilled to 5,206 ft.

The area is 2½ miles south of Harrisonburg. Drilling already is well under way on a confirmation test 1,400 ft. north.

Texas' Wilson Creek adds rich gas-condensate well

An exceptionally rich gas-condensate well has been completed in the old Wilson Creek area 4 miles southeast of El Maton, in Matagorda County, Texas Gulf Coast.

The well, drilled by Lion Oil Co. Division of Monsanto Chemical Co., flowed 330 bbl. of condensate per day with 5,650 M.c.f. of gas through ¼-in. choke.

Its flowing pressure registered 4.650 psi. Shut in, the top gas showed 6,150 psi.

Pay is the prolific lower Frio sand, perforated at 10,545-54 ft.

Wilson Creek was discovered in 1937 but has been unproductive for some time. It is only a few miles southeast of prolific El Maton field, discovered by Monsanto early in 1959.

Prolific gasser finaled in Southwest Kansas

South-central Seward County in southwestern Kansas has a prolific gas discovery at Falcon - Seaboard Drilling Co. 1 Peters in C NE SW 15-33s-33w, 5½ miles northwest of Hayne and 9 miles west of Kismet Multipay field.

The well was potentialed for a calculated open flow of 40,598 M.c.f.d. from upper Morrow Pennsylvanian at 5,680-5,700 ft.

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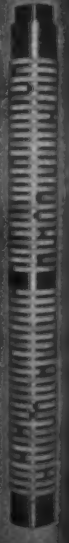

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NORTH TEXAS. In Wilbarger County, a low-cost acidizing treatment—engineered using the "Acid Guide"—increased production from a show to 12 boph flowing, on a 16/64 inch choke. The well had been completed in the five-foot Canyon lime pay at about 3870 feet. Treatment consisted of a 500-gallon spearhead of BDA* (Breakdown Acid), followed by 2000 gallons Dowell acid injected at five bpm. Results compared favorably with much larger jobs in similar wells.

OKLAHOMA. In McClain County, an operator saved $2000 in treating materials when he had Dowell engineer a treatment with the aid of the "Acid Guide."

The well had been completed into the Hunton lime in a field where the most frequent treatment was 20,000 gallons Retarded Acid (acid-oil emulsion type). The

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This new Dowell service employs glass *implosion* capsules to clean formations or reduce breakdown pressures ahead of fracturing or acidizing treatments. Hydrostatic pressure is used to break the capsules. This action releases powerful pressure waves — to remove scale and other deposits, break emulsion blocks, and to initiate fractures.

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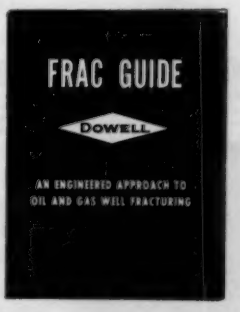

"Acid Guide" was used to see if desired results could be obtained with a less expensive job.

Calculations indicated that 12,000 gallons of fluid would do as well as 20,000. The actual treatment confirmed this prediction. The well went from one boph, pumping, to 10 boph, flowing. The operator considered this result highly satisfactory.

WEST TEXAS. An experiment was conducted on a well in the Strawn lime of Midland County to check the reliability of predictions made with the aid of the "Acid Guide." After a clean-up treatment using 360 gallons of BDA (Breakdown Acid), the well tested 27 bopd. Calculations made with the aid of the "Acid Guide" indicated that maximum penetration with *regular* acid could be obtained with 2000 gallons. A 2000-gallon treatment increased production to 53 bopd. An additional 4000 gallons of regular acid gave no production increase. Then, additional calculations using the "Acid Guide" indicated that greater penetration and more production would result from a treatment using 12,000 gallons of *Retarded Acid*. Following this last treatment, the well tested 84 bopd.

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Cambro-Ordovician pays off again in Ohio

Considerable interest is again focused on another Cambro-Ordovician discovery in Ohio.

C. R. Obermiller, the operator, has announced the 1 John Henderlog had a natural gas flow of 419 M.c.f.d. at the point of the Cambro-Ordovician contact at 5,713 ft. The location is in Section 36 of southeastern Canaan Township, Wayne County.

The decision to probe these sediments was made when the Clinton sand was found to be nonproductive and dry-hole commitments were negotiated with two majors. It is about 25 miles southwest of the 1A F. Smith producer in Hinckley Township, Medina County, completed by Ohio Fuel Gas Co., East Ohio Gas Co., and Wiser Oil Co. at this same horizon (OGJ, Feb. 16, 1959).

At present, Obermiller plans to connect the 1 Henderlog on line and conduct production tests before attempting any method of stimulation.

The rock pressure of this wildcat was reported as 2,065 psi.

Kewanee Oil Co. reports the confirmation well to the new pool discovery in southeast Dorset Township, Ashtabula County, had a gas flow of 1,032 M.c.f.d. after stimulation. The 1 Mamie Jewell, Section 2, logged the Clinton sand at 3,674-3,728 ft. and rocked to 1,230 psi. in 18 hours.

Also in Ashtabula County, action in Monroe Township included the completion by Union Carbide Corp. of 1 J. Estok, Section 10. This ½-mile stepout west of production, finaled at 2,549 M.c.f.d. natural in the Clinton pay at 3,165-92 ft.

Production tests under way at West Texas discovery

A Pennsylvanian discovery in southeastern Dawson County, West Texas, is taking production tests. The discovery well is Santiago Oil & Gas Co. 1 M. V. Bowlin, 2 miles northwest of Ackerly in Section 3, Block 34, T-3-N, T&P Survey.

The well flowed oil at the hourly rate of 60 bbl. through 25/64-in. choke from perforations at 9,505-12 and 9,481-91 ft. Location is 2 miles southeast of North Ackerly Pennsylvanian field.

Ward County. A Bell Canyon oil discovery for the area 7 miles south of Pyote is Continental Oil Co. 1-87 W. D. Black in Section 87, Block 34, H&TC Survey.

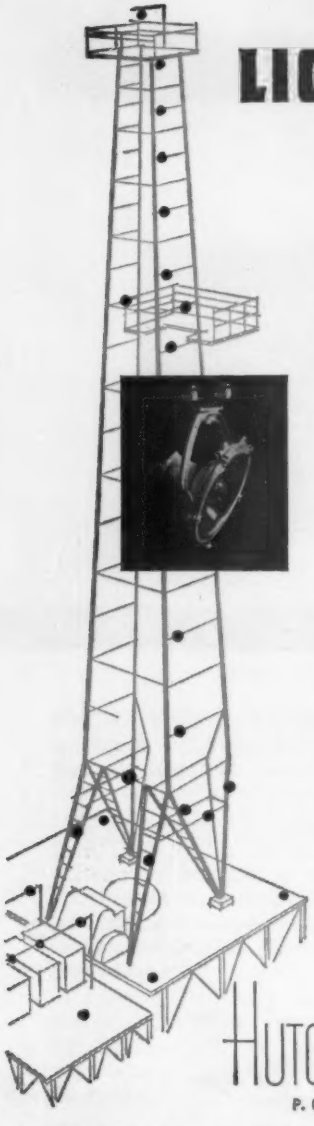
The pool discovery well flowed 241 bbl. of oil plus 221 bbl. of water on 24-hour potential test through 20/64-in. choke. Production is from perforations at 4,978-82, 5,032-40, and 5,094-5,106 ft. Location is 1 mile southeast of South Pyote 7,100-ft.-sand field.

Winkler County. Skelly Oil Co. has completed its important Ellenburger Cambro-Ordovician discovery 9 miles southeast of Kermit, the 167 S. M. Halley. The well flowed 385 bbl. of 41°-gravity oil on a 9-hour potential test through 1-in. choke. Calculated daily rate is 1,027 bbl.

Production is from open hole at 12,097-12,107 ft. This is also an indicated discovery in the Devonian, Fusselman, Montoya, and Waddell. Location is 1 miles southwest of Halley-Multipay field in Section 24, Block B-11, PSL Survey.

Pecos County. Clearfork production is reported in west-central Pecos County at Southern Minerals Oil Corp. and General Crude Oil Co. 1 Jasper CSL. The well, 28 miles southeast of Fort Stockton, flowed 165 bbl. of 31.8°-gravity oil per day plus 2% water in 24 hours through ½-in. choke. This discovery also had 6 M.M.c.f.d. and condensate during tests of the deeper Ellenburger at 10,286-10,491 ft. Location is Section 1, Block 104, Jasper CSL, 3 miles northwest of Hokit field.

"FLOLIGHT" DERRICK LIGHTING SYSTEMS



"FLOLIGHT" the quality derrick lighting system that requires no extra components.

When your drilling rig is equipped with a "Flolight" vaportight lighting system, you have a complete lighting arrangement. All motor leads, dog house lights, pump lights, etc., are included. There's nothing extra for you to buy.

"Flolight" systems are built specifically for drilling rigs, as a result you get more usable light for every dollar you invest. Each "Flolight" is mounted on a neoprene shock absorber that protects lamp filaments from breakage; eliminates the swaying of light fixtures in high winds. Light fixtures are constructed of aluminum alloy throughout, there's no enamel to chip, crack, or rust. Extra heavy, high temperature Pyrex lenses do away with cumbersome guards.

"Flolight" vaportight lighting systems are sold through supply stores everywhere.

HUTCHISON MANUFACTURING COMPANY

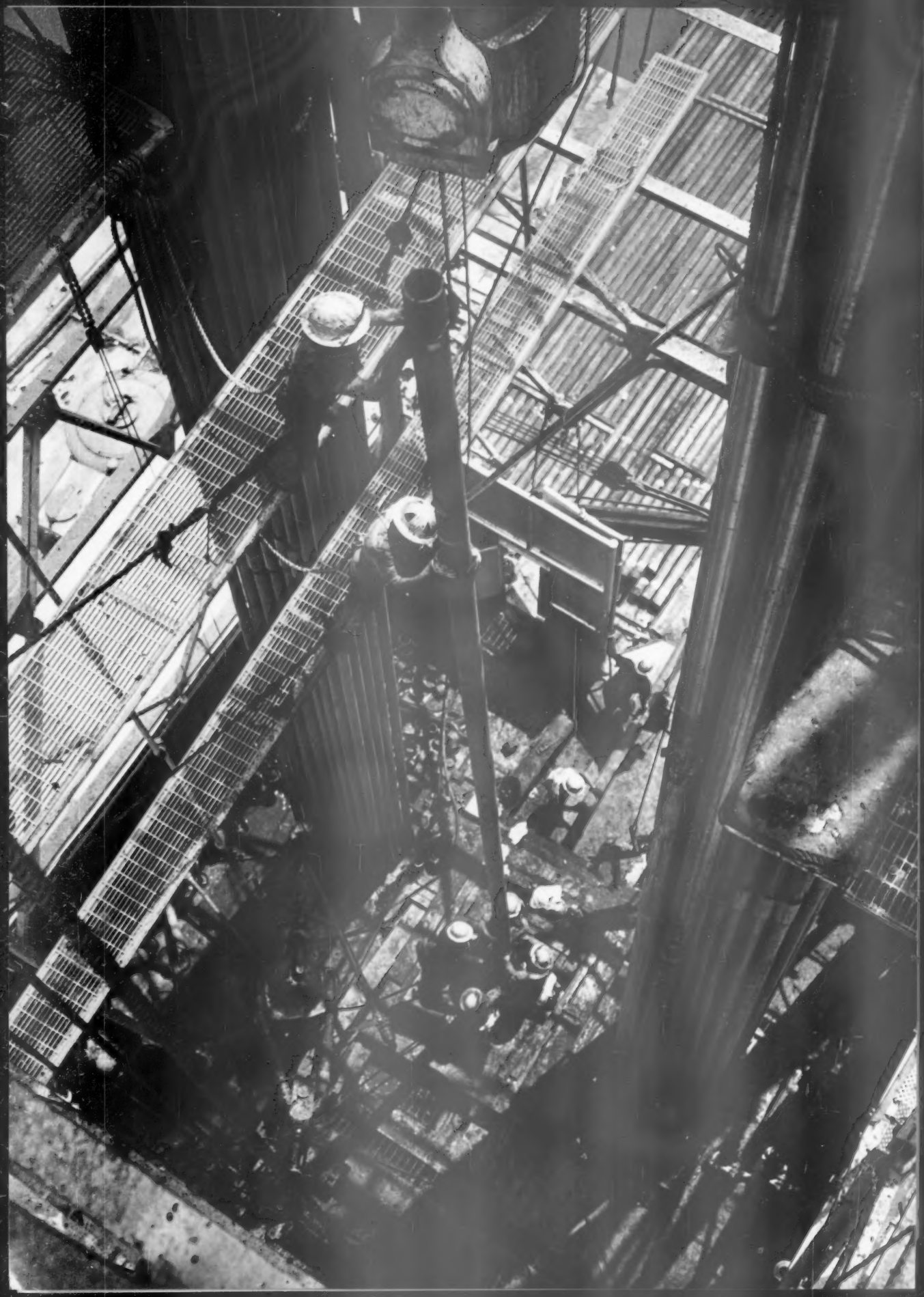
P. O. BOX 9335 • HOUSTON 11, TEXAS

A SUBSIDIARY OF REVERE ELECTRIC MANUFACTURING CO.

How SPANG Pipe measures up to perfection

This microscopic inspection of SPANG Extreme Line threads is one of National Supply's many tests to make sure pipe products are as close to perfection as man can make them. This 30″ comparator and measuring machine projects an image of the actual threads, enlarged over 30 times, onto a translucent template screen. Marked on the screen are the contours of perfect threads, with which the actual threads are compared. The machine is used for checking accuracy of inspection and production gauges, as well as finished products. This inspection technique is typical of National Supply's stringent quality control of all tubular products.

Read about SPANG Extreme Line casing on next pages



Why SPANG Extreme Line casing out-performs other casing in deep, high-pressure wells

1. HIGH JOINT STRENGTH

Basic design of the modified Acme thread with a small included flank angle permits joints to resist heavy axial loading as a unit. Broad, flat thread engagement eliminates pull-out failures common to conventional threaded joints.

2. POSITIVE RESISTANCE TO LEAKAGE

Unique metal-to-metal seal makes SPANG Extreme Line casing 100% leak resistant. Precision machined seals on box and pin ends bear up under the heaviest loads in tension and compression.

3. MINIMUM OUTSIDE DIAMETER

Integral joint eliminates couplings. Unique design provides greater strength with considerable reduction in diameter. Extreme Line casing affords greater clearances than T&C when run inside a given diameter of outer string or open hole.

4. MAXIMUM SPEED IN RUNNING

Cross threading is practically impossible. Any initial misalignment is automatically corrected by the broad, flat-crested threads which guide the pin quickly into positive engagement with the box.

High running speeds with SPANG Extreme Line casing were obtained at this Louisiana well.

Steel

Steel's Symbol of strength, long life, and economy

5. STREAMLINED EXTERIOR CONTOUR

There are no shoulders to hang up, catch on obstructions, or scrape the filter cake from the wall of the hole. Streamlined contour minimizes friction, speeds recovery when casing is pulled.

6. HIGH RESISTANCE TO DAMAGE

The strong, broad Acme-type threads on SPANG Extreme Line casing absorb and distribute the impact of accidental blows, which could seriously damage the "V" threads of T&C casing.

7. ABILITY TO BE RE-RUN

SPANG Extreme Line casing can be re-run many times without galling. The square, sturdy thread design affords higher recovery than API casing, without rethreading.

8. ONE-HALF LESS THREADED CONNECTIONS

Design of Extreme Line casing reduces the number of threaded connections to one-half those required with T&C casing because the coupling element is an integral part of the casing.

Next time you buy casing, investigate the many advantages of this superior quality casing. It is readily available in Grades J-55, N-80 and P-110. Call your National Supply representative for complete information.

Extreme Line casing is just part of National Supply's complete line of oil country tubular products. SPANG Drill Pipe and National Drill Collars were also used in this Louisiana well. National Supply is the only company manufacturing both drill pipe and tool joints.

Gathering line service is one of the many oil field applications for dependable SPANG CW Steel Pipe. In addition to gas, oil and water lines, you can use it for roof rails, step rails and many other structural purposes.

SPANG CW Steel Pipe is easy to cut, bend, thread and weld

When you specify SPANG CW Steel Pipe for oil, gas or water lines, you can be sure of top quality pipe . . . without premium prices.

SPANG quality control in every step of production and shipping is the answer. Every length of pipe is hydrostatically tested and inspected for strength and uniformity. Every length is made of carefully selected steel that meets stringent standards.

All sizes of SPANG CW Steel Pipe, plain end or threaded and coupled, are available now. Call your nearest National Supply representative for prompt, dependable delivery. You'll be glad you did.

THE NATIONAL SUPPLY COMPANY

Two Gateway Center, Pittsburgh 22, Pennsylvania

Subsidiary of Armco Steel Corporation

DIVISION OFFICES: Calgary, Columbus, Dallas, Denver, Houston, Torrance, Tulsa

EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London, E.C. 1

Canada July completions

	TOTAL WELLS							WILDCAT WELLS					
	Total	Oil	Gas	Dry	Service	Footage	Cum. 1960	Total	Oil	Gas	Dry	Footage	Cum. 1960
Western Canada	272	142	42	70	18	1,400,783	1,394	68	6	17	45	341,224	385
Alberta	182	83	36	45	18	1,044,989	930	46	3	15	28	238,291	250
Saskatchewan	72	50	2	20	0	259,057	316	18	3	1	14	63,302	68
Manitoba	5	4	0	1	0	9,921	38	0	0	0	0	0	6
British Columbia	13	5	4	4	0	86,816	97	4	0	1	3	39,631	48
Northwest Territories	0	0	0	0	0	0	13	0	0	0	0	0	13
Ontario	30	3	14	6	7	34,104	157	..	..	..	..	.....	....

North Texas has new Marble Falls discovery

The Marble Falls Pennsylvanian is producing at a new discovery in northwestern Stephens County, North Texas. Serene Oil Co. Inc. 1 Dance flowed 300 bbl. of oil daily on tests through 12/64-in. choke from perforations at 4,199 ft.

Location is in the Heirs of Johanna Koehler Survey, 12 miles northwest of Breckenridge and ½ mile south of 4,200-ft. production and 1¼ miles south of Boward Mississippian and Caddo field.

Geology course offered by Texas A&M

The Department of Geology and Geophysics at A&M College of Texas will offer a special course on "Fundamentals of Geology" for the petroleum industry from November 28 through December 22, 1960.

The course is designed for engineers, physicists, chemists, mathematicians and lawyers as well as for supervisory personnel who have had no formal training in geology but need a basic understanding of the geologic processes. The general plan and outline for the course has been patterned after a special course given for the past 4 years for the engineers of one major oil company.

The course will include a total of 54 hours of lecture and 75 hours of laboratory work during the 4-week period. In general, 3 hours each morning will be spent in lectures and 4 hours each afternoon in the laboratory. In addition, each student will be expected to complete rather extensive reading assignments. One field trip (Friday noon until Saturday night) will be given, with the students furnishing their own transportation or sharing expenses with other students having cars.

The registration fee is $250 and the course carries no college credit. Reservations should be made as soon as possible as the enrollment will be limited to approximately 25 men. Admission to the class will be based entirely upon the dates that applications are received. This course is part of the regular activities of the Department of Geology and Geophysics and the staff participates in this instruction without additional salary and as a part of their full-time effort.

Discovery likely for Powder River basin

There is promise of a small oil discovery in the Powder River basin area of extreme southwestern South Dakota.

Oil is flowing at the daily rate of 18 bbl. at Earl Sparks 1 Cornelison in C SW SW 26-5s-1e, Custer County. Production is from open hole at 665-765 ft. in an unidentified zone. Location is 8 miles northwest of a small Leo Pennsylvanian pool found 5 years ago in NE NW 34-6s-2e. There has been considerable drilling around this area of southwestern South Dakota, but no production. Dewey field in Wyoming, 8 miles southwest, is a now-depleted Pennsylvanian area.

Trenton is target of Michigan wildcat

Forrest H. Lindsay of Tulsa spudded first Trenton zone wildcat in far-northern Michigan following active lease play since early 1960 in the north end of the Lower Michigan Peninsula.

Lindsay's location, set up for 6,000 ft., is on Kirt 1, NW SW SE 6-30n-11w, Suttons Bay Township, Leelanau County. Lindsay awarded two other rotary contracts to Union Rotary Corp. for wildcats in Charlevoix and Presque Isle counties to be drilled this fall.

Cambridge arch area of Nebraska has new oil pool

Southern Nebraska's Kan-Neb basin picked up new Pennsylvanian Lansing-Kansas City oil production. The discovery well is Excelsior Oil Co. and M. W. Volentine 1 Schaffert in NE NE 4-2n-31w, Hitchcock County.

The well completed pumping 288 bbl. of oil daily, cut 10% water. Production is from perforations at 3,765 to 3,902 ft. Location is 11 miles northeast of Reiher field and 2 miles from any previous drilling.

Devonian oil flows at New Mexico wildcat

A wildcat discovery was completed in southeastern Lea County in southeastern New Mexico. Production at Forest Oil Co. 1 Federal-Lowe is from Devonian at 9,865-9,910 ft.

The well flowed 269 bbl. of oil daily through 11/64-in. choke. Location is in the NW SW 7-26s-38e in the extreme southeast corner of the county.

A recent Abo reef discovery was confirmed last week at James P. Dunigan 2 Denius Federal in NW SE 33-17s-33e. The well flowed 417 bbl. of oil daily through 22/64-in. choke from Abo reef topped at 8,538 ft. A third well is also showing for Abo production.

Discovery wells

ARIZONA

Apache County:

Texaco Inc. 1 Navajo "Z," NW SW 36-41n-30e. IPP 8 BO, 7 bbl. salt water per day, 41°, McCracken Devonian 6,758-93 ft. New field. TD 6,997 ft.

MISSISSIPPI

Marion County:

Texaco Inc., 1 Ted Padgett et al., SW NW NW 14-2n-12e. IP 132 BOPD (net), 7½ BWPD, ¾-in., 35.3°, GOR 300 cu. ft. per bbl., TP 100 psi., perf. 9,741-47 ft., Lower Tuscaloosa. TD 14,025 ft. New pay and extension of newly discovered Knoxo field.

NEW MEXICO

Lea County:

Forest Oil Corp. 1 Federal-Lowe, 8 miles southeast of Jal in 7-26s-38e. IPF 269 BOPD, 11/64-in. choke, 40.6°, TP 1,400 psi., packer, Devonian 9,865-9,910 ft. TD 12,950 ft. New oil discovery.

Ohio Oil Co. 1 Lea Unit, 15 miles southwest of Monument in 12-20s-34e. IPF 516 BO and 9 BW in 24 hours, 8/64-in. choke, 55.7°, GOR 321:1, TP 1,570

July footage breakdown . . . in the U. S.

	FIELD WELLS					WILDCAT WELLS			
	Oil	Cond.	Gas	Dry	Service	Oil	Cond.	Gas	Dry
Alabama	11,566	.....	.....	.....	.....	.....	.....	.....	2,646
Alaska	11,436	.....	.....	.....	.....	.....	.....	.....	.....
Arizona	.....	.....	.....	3,102	.....	.....	.....	.....	11,306
Arkansas	66,406	.....	.....	46,002	.....	6,512	.....	5,390	67,395
California	619,986	.....	33,548	140,073	3,699	19,109	.....	31,491	106,624
Colorado	34,819	.....	10,218	37,506	.....	8,405	5,777	5,583	68,202
Florida	.....	.....	.....	.....	.....	.....	.....	.....	12,525
Illinois	107,767	.....	.....	123,285	88,288	5,434	.....	.....	41,620
Indiana	26,952	.....	.....	33,774	925	4,607	.....	.....	37,241
Iowa	.....	.....	.....	.....	.....	.....	.....	.....	1,500
Kansas	285,550	.....	31,460	139,063	12,984	29,386	.....	5,381	209,379
Kentucky	51,334	.....	69,462	57,627	31,796	2,226	.....	3,969	20,310
Louisiana	682,435	300,624	126,909	564,219	2,209	77,388	12,438	8,335	316,494
North	116,252	.....	99,649	164,297	.....	18,162	.....	8,335	95,200
South	431,598	247,950	14,546	364,960	2,209	59,226	12,438	.....	178,566
Offshore	134,585	52,674	12,714	34,962	.....	.....	.....	.....	42,728
Michigan	134,065	.....	.....	91,579	31,368	.....	.....	2,774	96,882
Mississippi	178,412	8,302	.....	74,777	.....	46,228	14,000	.....	137,487
Missouri	.....	.....	.....	.....	.....	3,214	.....	.....	10,063
Montana	42,125	.....	5,385	13,499	.....	7,952	.....	.....	47,225
Nebraska	91,960	.....	.....	146,465	.....	29,150	.....	.....	215,303
New Mexico	339,666	7,660	140,173	50,715	1,113	15,536	29,472	7,331	93,608
West	49,283	7,660	139,223	3,533	.....	.....	.....	7,331	28,993
East	290,383	.....	950	47,182	1,113	15,536	29,472	.....	64,615
New York	10,840	.....	5,050	3,933	7,997	.....	.....	2,081	29,194
North Carolina	.....	.....	.....	.....	.....	.....	.....	.....	4,896
North Dakota	59,037	.....	.....	11,038	.....	4,213	.....	.....	72,370
Ohio	62,641	.....	62,085	18,108	9,093	.....	.....	8,613	12,004
Oklahoma	714,351	42,944	228,503	503,046	210,065	66,988	7,601	46,820	217,933
Oregon	.....	.....	.....	.....	.....	.....	.....	.....	5,879
Pennsylvania	100,751	.....	242,562	50,464	89,922	.....	.....	.....	13,424
South Dakota	8,667	.....	.....	8,526	.....	.....	.....	.....	.....
Tennessee	210	.....	.....	200	.....	.....	.....	.....	5,012
Texas	2,037,274	506,075	259,532	838,079	54,781	53,958	61,531	42,175	1,094,409
Dist. 1	61,380	.....	3,125	14,886	.....	3,400	.....	7,069	111,559
Dist. 2	123,682	47,285	37,723	73,893	.....	.....	10,390	.....	108,254
Dist. 3	220,734	78,839	14,434	135,205	.....	.....	10,410	.....	135,587
Dist. 4	66,861	96,932	46,340	75,757	3,875	10,340	20,981	4,890	90,683
East	196,311	57,949	.....	79,406	.....	.....	.....	.....	122,735
Dist. 7-B	158,485	3,925	82,818	105,095	10,005	11,064	.....	7,099	123,324
West	839,965	109,974	4,824	159,701	27,794	15,430	.....	23,117	202,236
Dist. 9	206,926	18,889	.....	150,278	10,283	13,724	11,275	.....	181,560
Dist. 10	162,930	92,282	70,268	43,858	2,824	.....	8,475	.....	18,471
Utah	51,278	.....	5,865	11,465	.....	.....	.....	.....	33,689
Washington	.....	.....	.....	.....	.....	.....	.....	.....	1,220
West Virginia	31,293	.....	200,725	9,115	2,220	.....	.....	.....	.....
Wyoming	190,275	.....	16,398	20,762	.....	4,508	.....	.....	152,989
Total July	**5,951,096**	**865,605**	**1,437,875**	**2,996,422**	**546,460**	**384,814**	**130,819**	**172,024**	**3,168,023**

. . . and in Western Canada

Western Canada	711,602	.....	133,386	118,767	95,804	27,672	.....	84,803	228,749
Alberta	513,131	.....	110,259	87,504	95,804	16,249	.....	72,858	149,184
Saskatchewan	165,047	.....	1,902	24,806	.....	11,423	.....	1,910	49,969
Manitoba	7,891	.....	.....	2,030	.....	.....	.....	.....	.....
British Columbia	21,533	.....	21,225	4,427	.....	.....	.....	10,035	29,596

psi., packer, Devonian 14,347-75 and 14,383-14,489 ft. TD 14,735 ft. PBTD 14,686 ft. New oil discovery.

NORTH DAKOTA

McHenry County:

The California Co. 1 Herdt-Bank of North Dakota, C NE NE 6-158n-80w. IPP 96 BO, 14 BWPD, 29.9°, Mission Canyon open hole 4,201-13 ft. Mission Canyon discovery, new field. TD 4,213 ft.

EAST TEXAS

Anderson County:

Fairway Operating Co. 1 W. B. Wofford, Joseph Fergusin Sur., ¾ mile northwest of Franston. IP 420 BOPD, 12/64-in., 47.3°, GOR 1,422 cu. ft. per bbl., TP 2,077 psi., perf. 9,959-72 ft., James (Rodessa). TD 10,164 ft. Extends Frankston field 1¾ miles southwest.

SOUTHWEST TEXAS

Kinney County:

J. P. Kiel Oil Co. 1 Joe N. Kerr, Jr., Meliton Valdez Grant, 6 miles west of Brackettville. IPP 26 BOPD, 36°, GOR 100 cu. ft. per bbl., perf. 1,750-60 ft., Glen Rose. TD 3,980 ft. Discovery well of Joe Kerr field—first commercial production in county.

TEXAS GULF COAST

Brazoria County:

Humble Oil & Refining Co. 1 South Angleton Gas Unit, Asa Mitchell League, A-96, 4½ miles southwest of Angleton. AOF 142 M.M.c.f.d., GLR 119 M.c.f. per bbl., 44.2°, shut-in TP 6,845 psi., perf. 12,167-73 ft. Frio. TD 13,044 ft. Discovery well of South Angleton field.

WEST CENTRAL TEXAS

Shackelford County:

A. V. Jones & Sons 1-B J. Carter King, 5 miles south of Albany, Sec. 39, BAL

(Continued on page 151)

July's well completions in the U. S.

State—	Total completions											Wildcats							
	Total	Oil	Cond.	Gas	Dry	Service	Footage	Cum. wells 1960	Cum. footage 1960	Cable-tool comp.	D.D.	Total	Oil	Cond.	Gas	Dry	Footage	Cum. wells 1960	Cum. footage 1960
Alabama	2	1	0	0	1	0	14,212	28	300,804	0	0	1	0	0	0	1	2,646	2	5,292
Alaska	1	1	0	0	0	0	11,436	8	96,001	0	0	0	0	0	0	0	0	3	38,029
Arizona	10	0	0	0	10	0	14,408	18	34,440	0	0	7	0	0	0	7	11,306	15	31,338
Arkansas	54	26	0	1	27	0	191,705	356	1,305,525	0	0	18	2	0	1	15	79,297	97	388,057
California	243	183	0	12	47	1	954,530	933	4,336,792	2	0	33	2	0	4	27	157,224	170	919,701
Colorado	43	10	1	4	28	0	170,510	356	1,718,074	0	3	24	2	1	2	19	87,967	175	849,389
Florida	1	0	0	0	1	0	12,525	4	46,332	0	0	1	0	0	0	1	12,525	4	46,332
Illinois	197	50	0	0	97	50	366,394	1,189	2,359,478	*26	9	27	3	0	0	24	47,054	252	448,848
Indiana	74	20	0	0	53	1	103,499	543	742,674	*39	3	31	4	0	0	27	41,848	209	266,037
Iowa	1	0	0	0	1	0	1,500	3	3,507	1	0	1	0	0	0	1	1,500	3	3,507
Kansas	198	89	0	9	97	3	713,203	1,848	6,560,530	21	0	66	7	0	1	58	244,146	605	2,236,854
Kentucky	163	43	0	29	59	32	236,724	946	1,331,302	*101	0	20	2	0	4	14	26,505	111	163,661
Louisiana	276	113	23	27	112	1	2,091,051	1,996	16,170,953	0	0	49	9	1	1	38	414,655	319	2,803,901
North	127	48	0	25	54	0	501,895	722	2,844,852	0	0	24	4	0	1	19	121,697	149	768,667
South	124	52	19	1	51	1	1,311,493	981	10,182,951	0	0	22	5	1	0	16	250,230	149	1,761,167
Offshore	25	13	4	1	7	0	277,663	293	3,143,150	0	0	3	0	0	0	3	42,728	21	274,067
Michigan	107	37	0	1	51	18	356,668	468	1,581,668	42	0	27	0	0	1	26	99,656	130	476,783
Mississippi	46	21	2	0	23	0	459,206	408	4,119,484	0	0	20	4	1	0	15	197,715	149	1,473,931
Missouri	4	1	0	0	3	0	13,277	26	41,649	4	0	4	1	0	0	3	13,277	26	41,649
Montana	24	7	0	2	15	0	116,186	171	819,786	3	0	13	2	0	0	11	55,177	82	342,086
Nebraska	91	25	0	0	66	0	482,878	490	2,744,832	0	5	47	6	0	0	41	244,453	205	1,094,483
Nevada	0	0	0	0	0	0	0	2	7,902	0	0	0	0	0	0	0	0	2	7,902
New Mexico	131	69	3	26	32	1	685,274	1,062	5,103,938	36	0	25	2	2	1	20	145,947	167	840,971
West	48	11	1	25	11	0	236,023	348	1,550,372	11	0	10	0	0	1	9	36,324	39	154,097
East	83	58	2	1	21	1	449,251	714	3,553,566	25	0	15	2	2	0	11	109,623	128	686,874
New York	26	8	0	3	8	7	90,370	184	349,224	26	0	6	0	0	1	5	31,275	27	99,462
North Carolina	3	0	0	0	3	0	4,896	3	4,896	3	0	3	0	0	0	3	4,896	3	4,896
North Dakota	25	12	0	0	13	0	146,658	176	1,120,948	0	1	11	1	0	0	10	76,583	46	255,036
Ohio	72	30	0	25	14	3	172,544	565	1,378,461	72	0	5	0	0	2	3	20,617	32	110,685
Oklahoma	740	310	6	45	185	194	2,038,251	2,710	10,642,880	191	6	56	9	1	7	39	339,342	442	2,314,669
Oregon	4	0	0	0	4	0	5,879	7	16,685	4	0	4	0	0	0	4	5,879	7	16,685
Pennsylvania	207	59	0	53	14	81	497,123	518	1,436,370	189	4	3	0	0	0	3	13,424	10	62,605
South Dakota	2	1	0	0	1	0	17,193	17	119,144	0	0	0	0	0	0	0	0	6	24,848
Tennessee	9	1	0	0	8	0	5,422	49	37,998	9	0	7	0	0	0	7	5,012	45	36,779
Texas	1,175	526	65	77	485	22	4,947,814	9,202	39,469,486	64	19	295	13	6	8	268	1,252,073	1,909	8,665,875
District 1	86	38	0	2	46	0	201,419	637	1,767,930	0	1	38	1	0	1	36	122,028	245	759,600
District 2	59	16	6	10	27	0	401,227	436	2,912,550	0	2	16	0	1	0	15	118,644	105	736,716
District 3	89	41	9	3	36	0	595,209	709	4,919,875	0	2	14	0	1	0	13	145,997	131	1,164,536
District 4	73	19	12	10	30	2	416,659	621	3,450,281	2	1	19	2	2	1	14	126,894	181	1,027,834
East	91	45	8	0	38	0	456,401	728	3,406,251	0	1	21	0	0	0	21	122,735	154	869,352
District 7-B	176	61	1	26	84	4	501,815	1,331	3,770,598	0	1	45	3	0	2	40	141,487	373	1,124,668
West	287	183	13	5	76	10	1,383,041	2,431	12,151,725	24	4	49	4	0	4	41	240,783	381	1,693,284
District 9	225	82	3	0	135	5	592,935	1,709	4,326,246	38	6	90	3	1	0	86	206,559	300	970,384
District 10	89	41	13	21	13	1	399,108	600	2,764,030	0	1	3	0	1	0	2	26,946	39	319,501
Utah	19	9	0	1	9	0	102,297	151	841,235	0	0	7	0	0	0	7	33,689	52	290,414
Washington	1	0	0	0	1	0	1,220	2	9,740	1	0	1	0	0	0	1	1,220	2	9,740
West Virginia	109	16	0	88	4	1	243,353	465	1,140,870	106	0	0	0	0	0	0	0	4	27,058
Wyoming	84	45	0	3	36	0	384,932	593	2,937,626	3	3	29	1	0	0	28	157,497	239	1,272,218
Total July 1960	**4,142**	**1,713**	**100**	**406**	**1,508**	**415**	**15,653,138**	**25,498**	**108,931,234**	**943**	**53**	**841**	**70**	**12**	**33**	**726**	**3,855,680**	**5,550**	**25,700,996**
Total June 1960	4,180	1,961	114	272	1,727	106	18,010,750	.....	.....	578	61	952	79	9	25	839	4,405,631	....	.....
Cumulative 1960	**25,498**	**11,756**	**758**	**2,063**	**9,894**	**1,027**	**108,931,234**	.....	.....	**4,447**	**332**	**5,550**	**487**	**62**	**184**	**4,817**	**25,700,996**	....	.....
Cumulative 1959	29,095	14,737	711	2,077	10,791	779	120,250,832	.....	.....	....	....	5,480	532	77	162	4,709	26,934,460	....	.....

*Estimated.

Swearingen Takes Indiana Standard Helm

Retirement of Frank Prior, right, chairman of Standard Oil Co. (Ind.), brings additional title of chief executive officer to John E. Swearingen, left, president. The office of chairman will be discontinued.

Prior retired August 25 after 41 years with the company and its affiliates. Before being named chairman and chief executive officer in 1958, Prior had been production vice president, executive vice president, and president of the company. He also had served as president of two subsidiaries—Dixie Oil and Pan American Petroleum.

Swearingen, who will be 42 September 7, joined the company in 1939 as a chemical engineer. He moved from research to production, serving for a time as manager of the Pan American (then Stanolind) central division in Oklahoma City. In 1951, he was named general manager of production for Indiana Standard. He then moved up rapidly as a director of the company, vice president in charge of production, and executive vice president. He was elected president in 1958.

Thomas P. Shaw, petroleum engineer for Sinclair Oil & Gas Co. in Tulsa, and **Wesley J. Burris,** petroleum engineer in the Bairoil, Wyo., district, have been transferred to Denver.

Alva M. Caster has joined the North Dakota Geological Survey in Grand Forks as petroleum engineer. **Arthur D. Carter, Jr.,** has joined the Grand Forks office as statistician. **Wesley D. Norton** has joined the survey in Williston, N. D., as inspector.

E. F. Jacobs, administrative coordinator, domestic marketing department, for Gulf Oil Corp., has been named coordinator of sales development in the company's new Houston marketing headquarters. **C. B. Prescott,** general manager of Gulf's New Orleans sales division, has been named coordinator, supply, in Houston. **E. W. Campbell,** coordinator of direct sales, has been appointed manager of national accounts, Houston. **Paul Jones,** coordinator of financial and services in the domestic marketing department, has been named assistant comptroller responsible for financial affairs in the Houston marketing department.

J. W. Wilt, research and supervising production engineer for Honolulu Oil Corp. in Taft, Calif., has retired after 32 years with the company. He has opened consulting offices in Bakersfield, Calif., specializing in production and corrosion-control problems.

Dr. W. A. Bruce has been named senior research associate for Jersey Production Research Co. in Tulsa. Bruce has been on assignment with Standard Oil Co. (N. J.) in New York. He was division manager, production, for Jersey Production Research before the New York assignment.

▶▶▶ Personals

Hardin E. Littell, production engigineer with Cities Service Oil Co., has been transferred to Electra, Tex., from Wichita Falls.

Jerry Lamb, refinery bulk sales representative for Union Oil Co., has joined Reid Oil Co., Long Beach, Calif., as general manager of marketing. He will be in charge of wholesale accounts and will manage independent marketing operations in California, Arizona, Nevada, and southern Oregon.

E. F. Glasgow has been named superintendent of the Oklahoma district of Phillips Petroleum Co.'s natural-gasoline department. He succeeds **H. F. Chapman,** who has retired after 34 years with the company. Glasgow has been assistant superintendent and engineer in the Oklahoma district. In the natural-gasoline department's western district, Odessa, Tex., **L. N. Anderson** has been named assistant superintendent. He had been on special assignment in Bartlesville, Okla.

A. Rowland Boucher, formerly vice president of Alex W. McCoy & Associates, Inc., has been appointed vice president and chief of geological research for King-Stevenson Oil Co., Inc. He will headquarter in Denver. **Russell E. Hayward** has been named vice president of King-Stevenson Oil, Ltd., Canadian subsidiary. He will be manager of Canadian operations. Hayward was vice president and Canadian exploration manager for Alex W. McCoy & Associates before joining King-Stevenson. He will headquarter in Calgary.

Robert B. Phillips, director of plans and programing in market-coordination for Gulf Oil Corp. in Pittsburgh, has been appointed manager of the New York sales division. He succeeds **James B. Kelley,** who recently was elected eastern regional vice president, marketing. **Ira F. Archer,** district manager in Pittsburgh for Gulf, has been named manager of the new Pittsburgh sales division office. **B. R. Lawlor,** division manager of retail and jobber sales in Philadelphia, has been appointed Philadelphia sales division manager. **H. A. Goddard** has been named manager of the Syracuse division. He had been division manager of direct sales in Philadelphia. **A. A. Stambaugh, Jr.,** manager of retail and jobber sales in the Boston sales division, has been named division manager there. He succeeds the late D. R. Ferris.

O. Wayne Crisman, manager of Delhi-Taylor Oil Corp.'s McAllen, Tex., district, has been promoted to general manager of the production division in Dallas. In other production division changes in Dallas, **J. H. Doughman,** chief engineer, production - engineering department, has been promoted to manager of production department, Dallas. **R. S. Wansbrough,** staff petroleum engineer, will succeed Doughman. **H. P. Kerr,** general superintendent, has been named manager of the new production technical service department. **W. S. McCready,** production supervisor, will be assistant manager, production technical service. In McAllen, **Clinton H. Britsch,** district engineer, will succeed Crisman as district superintendent. **G. T. Higginbotham,** staff petroleum engineer in Dallas, will succeed Higginbotham.

CRISMAN

A. C. Garner, Jr., district supervising engineer for Humble Oil & Refining Co., Humble division, has been transferred to Morgan City, La., from Franklin, La., in a relocation of district headquarters.

Morris Morrow, head of the product-quality section of Humble Oil & Refining Co.'s research department in Baytown, Tex., has joined Esso Research & Engineering Co. on a 1-year rotational assignment as head of the products-application section, products-research division.

J. K. Lydecker, division geologist in Sinclair Oil & Gas Co.'s West Texas division, Midland, has been promoted to division exploration superintendent in Fort Worth. **A. D. Brixey, Jr.,** division geologist in Houston, has been transferred to the Fort Worth division. **R. P. Harder,** executive assistant with the general staff geological department in Tulsa, will succeed Brixey in Houston. **W. D. McEachin,** division geologist in Fort Worth, will move to Tulsa to succeed Harder.

Bill Sturm, senior engineer at the Bayway refinery of Humble Oil & Refining Co.'s Esso Standard division, Linden, N. J., has been promoted to group head in petroleum technical service. **Dick Eccles,** engineer, has been named senior engineer, petroleum technical service and **Ed Slater** has moved up from engineer to senior engineer in mechanical technical service.

Henry Flynn, process engineer with American Oil Co. in Yorktown, Va., has been transferred to Amoco Chemicals Corp. as process engineer in Joliet, Ill.

Fred T. Kottenstette, chemical salesman for Texas Butadiene & Chemical Corp., in Houston, has been promoted to group leader, sales development, and transferred to New York.

L. P. Lowery, production district foreman for Humble Oil & Refining Co.'s Carter division, has been transferred to St. Elmo, Ill., from Mattoon, Ill.

John H. Weems, division staff geologist in Oklahoma City for Sohio Petroleum Co., has joined the geological staff of Associated Oil & Gas Co. He will headquarter in Houston.

Douglas J. Youngblood, Paul A. Cook, William B. Braden, Jr., and **Billy H. Cummins** have joined the Port Arthur, Tex., refinery of Texaco Inc. as chemical engineers.

Maurice M. Holgate has been named director of the new engineering department of Gallup, Buckland, & Farney, Ltd., Calgary consulting geological firm. The new department will specialize in reservoir problems.

John F. Harron, manager of Sun Oil Co.'s Toledo refinery, has been named to succeed **Paul D. Barton** as director of the advanced management and methods division in Sun's manufacturing department. The appointment will become effective when Barton retires later in the year. Harron will headquarter in Marcus Hook, Pa. **Herbert C. Thober,** superintendent of the Toledo refinery, will succeed Harron as manager. **K. E. Leutz,** assistant superintendent in Toledo, moves up to succeed Thober, and **John F. McKinney, Jr.,** operating assistant at Sun's Marcus Hook refinery, succeeds Leutz.

James R. Arrington, manager of the economics department of Humble Oil & Refining Co.'s Carter division, has been transferred to Houston from Tulsa. **Robert D. Mannix** and **Robert E. Megill,** economists, and **J. D. Rainwater,** analyst, also will move to Houston from Tulsa.

Stuart A. Milster, sales manager of Dow Chemical Co.'s Bay Refining Co. division, has been named general manager of the company in Bay City, Mich. He succeeds **W. Rolland Stewart,** who recently resigned. Milster has been with Dow since 1940. He joined the Bay division in 1947 as superintendent of distribution.

▶▶▶ Personals

Dr. Glenn S. Visher has joined Sinclair Research Laboratories, Inc., as a research geologist in the Tulsa lab.

Philip R. Sayre, process engineer with General Tire & Rubber Co., has been promoted to technical superintendent of the company's Ashtabula, Ohio, chemical plant.

Philip J. Byrne, Jr., deputy for engineering for Esso Research & Engineering Co., has been named special assistant to management to work with the company's continuing analysis of operations.

Thomas B. Kimball has been elected executive vice president, operations, for Sinclair Oil Corp. He had been a director of Sinclair and president and chief executive officer of its manufacturing and marketing subsidiary, Sinclair Refining Co. **C. J. Allen,** vice president of the parent company, will succeed Kimball as president of Sinclair Refining. Allen was executive vice president of the refining company before being named vice president of Sinclair Oil in 1957. In his new post, Kimball will coordinate the operating activities of all domestic and foreign subsidiaries for the parent company.

KIMBALL

ALLEN

Nelson D. Griswold, assistant manager of Dow Chemical Co.'s Texas division and a director of Dow and of Brazos Oil & Gas Co., has been named a fellow in the American Society of Mechanical Engineers. The award recognizes outstanding contributions to engineering.

F. M. Burk, manager of private-brand sales for Phillips Petroleum Co., has been appointed assistant sales manager in charge of the western sales divisions. These include the Amarillo, Tex., Wichita, Denver, Salt Lake City, and Spokane divisions. **E. C. McManus,** manager of the Salt Lake City division, will succeed Burk as private-brand sales manager. **D. A. Johnson,** senior assistant manager of the Salt Lake City division, will replace McManus.

Personals

Charles P. Moreton, supervisor of gas contracts for Texas Gas Transmission Corp., has been appointed manager of gas contracts. He will be responsible for acquisition of gas reserves, negotiation of gas-purchase contracts, and allocation of markets to the contracts through proration. Moreton was with Arkansas Louisiana Gas Co. as gas-supply engineer before joining Texas Gas in 1953.

Howard M. McDonald, Jr., district measuring engineer for Columbia Gulf Transmission Co. in Rayne, La., has joined Mid-America Pipeline Co. as district superintendent in Liberal, Kans.

Frederick A. Woltz, southern production district construction foreman for Ohio Fuel Gas Co., has retired after 43 years with the company.

Charles M. Hunter, assistant general superintendent of Southern Natural Gas Co., has been promoted to general superintendent. He has been with the company since 1941.

Paul G. Doran, assistant to the general manager of Texas Eastern Transmission Corp.'s Little Big Inch division, has been named district foreman in Seymour, Ind. **Merle S. Greaves,** who had been Seymour district foreman, will replace Doran in Houston.

G. P. George, field-lines superintendent for El Paso Natural Gas Co., has been promoted to assistant superintendent of the San Juan division, Farmington, N. M. **Charles H. Coffin,** senior engineer for El Paso Natural Gas Products Co., has been named a project engineer in the project and mechanical engineering section.

Stevens G. Herbst, engineer with Lone Star Gas Co. in Dallas, has joined Transwestern Pipeline Co. as quality-control engineer in Houston.

Dr. Franc A. Landee, director of Dow Chemical Co.'s computations laboratory, has been promoted to research scientist.

G. W. (Bill) Hoffman, Jr., petroleum engineer with Amerada Petroleum Corp., has been transferred to Tulsa from Houston.

Dr. Gerald A. Harlow has been named research supervisor in the analytical department of Shell Development Co.'s Emeryville, Calif., research center.

James S. Miner, field engineer for Texaco Inc. in Conroe, Tex., has been transferred to Liberty, Tex., as petroleum engineer in the reservoir department.

W. J. Wirkus has joined Shell Chemical Co.'s technical service laboratory in Union, N. J., as chemist, industrial chemicals. **L. L. McClain** has joined the lab as assistant in plastics and resins.

Russell Brown couldn't stay retired. He has opened a law office in Washington. Brown stepped down January 1 as general counsel of the Independent Petroleum Association of America after 30 years on that job. He plans to specialize in oil and gas consulting and legal work.

George G. Shearrow, formerly head of the subsurface and oil and gas sections of the Ohio Geological Survey, has resigned to open offices as a consulting geologist in Columbus, Ohio.

John M. Penrod, head of the Evansville, Ind., office of James A. Lewis Engineering, Inc., Dallas, has been named manager of the company's new Wichita district office. **A. D. Fox,** Evansville, has been named head of the company's new Long Beach, Calif., office.

Douglas G. G. Levick, assistant coordinator of marketing for Standard-Vacuum Oil Co., has been appointed coordinator of marketing. He will direct Stanvac's marketing activity in over 50 countries and territories in the Far East, southern and East Africa, Australia, and New Zealand. He succeeds the late Mac Donell Roehm. Levick was with the old Carter Oil Co. and Esso Standard Oil Co., subsidiaries of Standard Oil Co. (N. J.), before joining Stanvac in 1948. He will headquarter in White Plains, N. Y.

William R. Pearce, Bismarck, N. D., attorney, has been reelected president of the North Dakota Oil and Gas Association. New officers are **Burrel Harell,** Williston drilling contractor, vice president; and **Evan Saltzman,** First National Bank of Bismarck, treasurer. Reelected were **Robert L. Connell,** Sun Oil Co.; **Hugh E. Palmer,** Cardinal Petroleum Co.; and **William E. Sloan,** Ohio Oil Co., vice presidents, and **Clifford Jansonius,** Bismarck attorney, secretary.

Deaths

Walter L. Foster, 78, head of Foster Construction Co. and Foster Investment Co., Tulsa, died August 22 in a Tulsa hospital. Foster was founder of the geology department at the University of Tulsa and taught in the school for 8 years.

Harry E. Hoare, 59, assistant oil editor of the Amarillo, Tex., News and Globe-Times, died August 20 in Amarillo after a long illness.

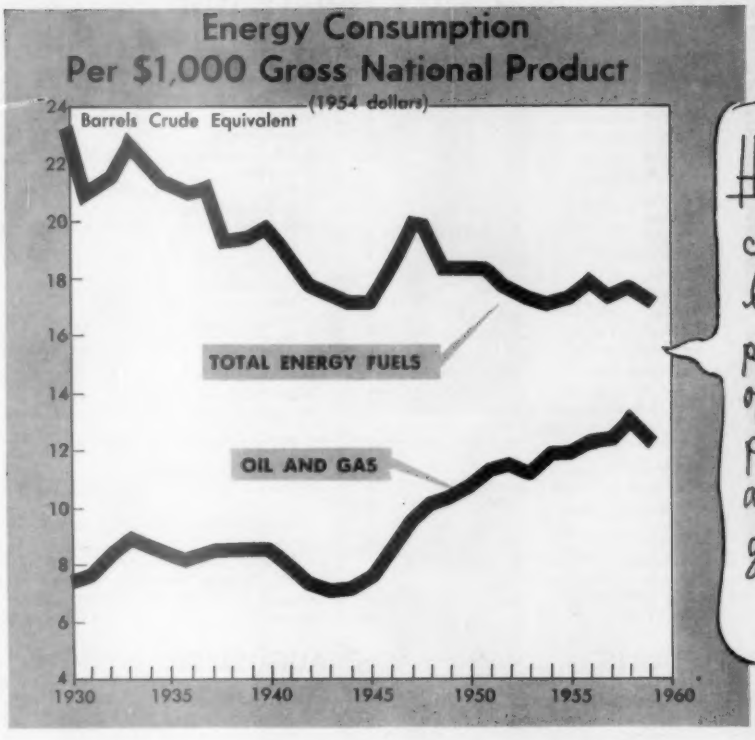
J. I. (Doc) Burton, 38, spread superintendent for Panama-Williams Corp., died August 16 in Warsaw, Wis., of a heart ailment. A long-time pipeliner and former professional rodeo rider, Burton was preparing to participate in a local rodeo when stricken. Panama-Williams has a spread in the Warsaw area.

George W. Kasserman, retired Denver division land manager for Shell Oil Co., died August 19 in a Denver hospital. Kasserman retired in January after 22 years with Shell.

Clyde Allen Babb, 44, field superintendent for Layton Oil Co., Independence, Kans., died August 24 in a Sapulpa, Okla., hospital of a heart ailment.

Charles H. Goss, 71, consultant to Sonneborn Chemical & Refining Corp., and retired manager of the company's Franklin, Pa., refinery, died August 15 in a Cleveland hospital. Goss was superintendent of the Franklin refinery before being named manager in 1950. He retired in 1954.

James J. Cosgrove, 73, retired chairman of Continental Oil Co., died August 22 at his home in New York City after a long illness. Cosgrove retired in 1958 after 29 years with Conoco. He was vice president and general counsel before becoming board chairman in 1946.



Oil may follow the GNP curve in the 60's

JOHN C. CASPER

SOMETHING HAS TO GIVE. Crude and natural gas can't continue to show gains in relation to gross national product when total energy per unit of GNP is declining.

The top line on the chart represents the amount of energy consumed each year for $1,000 of GNP. There has been a definite downward trend, meaning less energy is required to maintain GNP at a given level than was needed in the earlier years of the period.

For convenience in comparing the two series, total energy for the top line is expressed in equivalent barrels of crude. Average crude has about 5,800,000 B.t.u. per barrel.

Back in 1930, people in this country used the equivalent of 23.4 bbl. of crude to generate $1,000 of GNP. The average was down to 20 bbl. in 1940 and to 17.3 bbl. in 1954. The line shows a general leveling off since 1954.

Gross national product is measured in dollars. To correct for variations in the value of the dollar, GNP has been stated in constant-value 1954 dollars, using deflators developed by the Department of Commerce.

There have been several reasons for the decline in total fuel consumption per unit for GNP. The most important has been increased efficiency in energy use. For example, diesel units have replaced almost all of the old steam locomotives. And, power plants have increased the amount of electric energy from a pound of coal or a gallon of residual fuel.

While total energy per unit of GNP was declining, there was a sharp gain in use of oil and gas. Most of the increase came after World War II. Consumption of oil and gas per thousand dollars of GNP jumped from 7.3 bbl. in 1944 to 11.0 bbl. in 1950 and to 12.5 bbl. in 1956. Oil and gas gained by replacing other energy fuels.

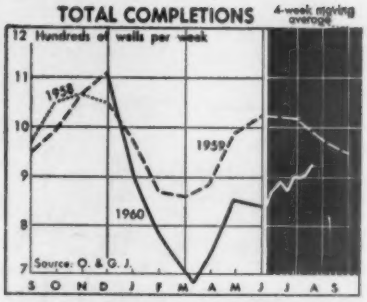
When petroleum can no longer supplant other energy fuels, the ratio of oil to GNP will follow the same trend as that for total energy.

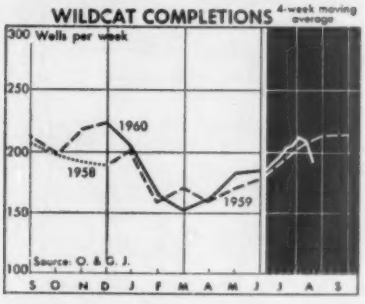
The end result could be a downturn in oil and gas use per unit of GNP. This leveling off probably will come in the sixties.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,859,830	UP	31,280	UP	111,220
Crude stocks	238,679,000	DOWN	2,484,000	DOWN	23,169,000
Completions	867	DOWN	113	DOWN	84
Refinery runs	8,135,000	DOWN	200,000	DOWN	79,000
Gasoline stocks	192,310,000	UP	472,000	UP	10,888,000
Kerosine stocks	31,368,000	UP	144,000	UP	1,420,000
Distillate stocks	143,831,000	UP	3,184,000	DOWN	9,853,000
Residual stocks	44,314,000	UP	345,000	DOWN	11,753,000
Four-product stocks	411,823,000	UP	4,145,000	DOWN	9,298,000
Total imports	1,628,300	UP	280,100	UP	43,300

DRILLING





Active Rotary Rigs

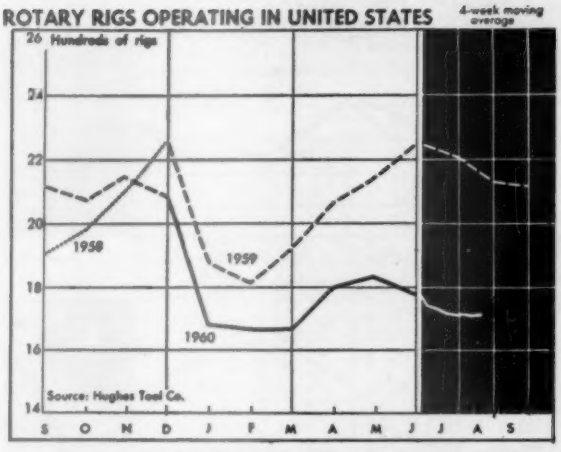
	8-22-60	8-15-60	8-24-59
Alabama	4	4	9
Alaska	7	7	(†)
Arkansas	13	13	14
Arizona	1	1	2
California	82	83	92
Land	81	81	90
Offshore	1	2	2
Colorado	44	37	56
Florida	2	2	2
Land	2	2	1
Offshore	0	0	1
Illinois	39	38	39
Indiana	11	9	7
Iowa	0	0	2
Kansas	112	100	129
Kentucky	3	3	7
Louisiana	291	299	345
North	38	41	46
S. Inland waters	112	121	139
S. Land	78	75	110
Offshore	63	62	50
Maryland	1	1	0
Michigan	45	41	28
Mississippi	56	61	74
Missouri	1	1	1
Montana	24	23	28
Nebraska	19	19	27
Nevada	0	0	1
New Mexico	112	112	117
New York	0	0	1
North Dakota	14	16	25
Ohio	3	6	3
Oklahoma	157	163	201
Oregon	1	1	0
Pennsylvania	9	13	12
South Dakota	0	0	7
Tennessee	1	0	0
Texas	560	551	791
S. Inland waters	2	5	5
S. Land	171	169	215
Offshore	0	0	1
North	45	44	179
Panhandle	42	39	(*)
East	48	45	(*)
West Central	145	152	250
West	107	97	141
Utah	30	30	34
Washington	1	1	2
West Virginia	5	5	8
Wyoming	62	62	76
Total U. S.	**1,710**	1,702	2,140
Western Canada	172	160	163
Eastern Canada	0	0	0
Grand total	1,882	1,862	2,303

Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting. †Data first reported 4-4-60.

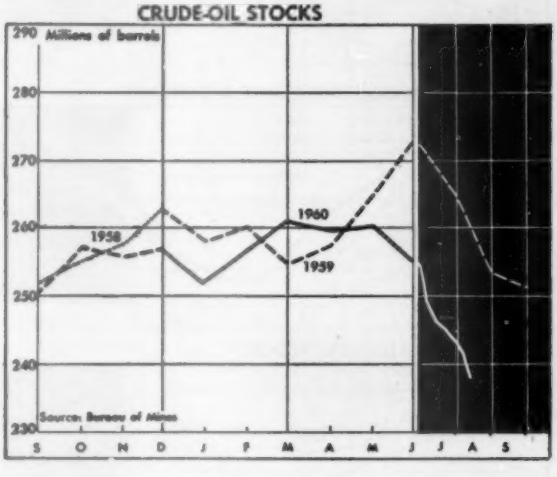
WEEKLY WELL COMPLETIONS . . . WEEK ENDED AUGUST 20, 1960

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	0	0	0	0	0	0	0	31	61	0	0	0	0	0	2	16
Arizona	0	0	0	0	0	0	0	25	. . .	0	0	0	0	0	18	. . .
Arkansas	13	6	0	0	7	0	41,780	379	542	5	1	0	0	4	104	93
California	32	20	0	3	9	0	150,720	1,048	967	4	0	0	1	3	197	240
Colorado	14	0	0	7	7	0	71,649	399	485	6	0	0	1	5	200	290
Illinois	69	13	0	0	18	38	132,238	1,362	1,398	8	1	0	0	7	288	234
Indiana	34	11	0	0	23	0	43,213	628	522	8	0	0	0	8	232	172
Kansas	90	38	0	2	34	16	268,494	2,049	2,570	23	4	0	0	19	659	606
Kentucky	70	4	0	1	13	52	79,482	1,163	1,544	3	0	0	0	3	117	139
Louisiana	78	39	8	6	25	0	588,676	2,218	2,309	13	3	0	0	10	350	312
North	34	18	0	3	13	0	123,856	825	854	8	3	0	0	5	169	128
South	35	14	8	2	11	0	367,240	1,074	1,212	4	0	0	0	4	158	172
Offshore	9	7	0	1	1	0	97,580	319	243	1	0	0	0	1	23	12
Michigan	20	10	0	0	10	0	71,809	554	396	3	0	0	0	3	148	99
Mississippi	11	6	1	0	4	0	103,691	438	398	3	0	0	0	3	164	179
Montana	3	1	0	0	2	0	15,439	188	205	2	0	0	0	2	91	62
Nebraska	23	7	0	0	16	0	128,539	560	559	9	0	0	0	9	230	242
New Mexico	38	21	0	10	4	3	216,985	1,181	1,297	4	1	0	0	3	183	156
West	9	1	0	7	1	0	50,845	387	596	1	0	0	0	1	42	44
East	29	20	0	3	3	3	166,140	794	701	3	1	0	0	2	141	112
New York	0	0	0	0	0	0	0	205	172	0	0	0	0	0	26	16
North Dakota	8	7	0	0	1	0	42,687	192	320	1	0	0	0	1	50	61
Ohio	19	8	0	7	4	0	48,989	633	616	1	0	0	0	1	34	18
Oklahoma	35	13	1	2	7	12	93,505	2,954	3,701	2	0	1	0	1	475	545
Pennsylvania	0	0	0	0	0	0	0	440	335	0	0	0	0	0	8	9
South Dakota	0	0	0	0	0	0	0	17	. . .	0	0	0	0	0	6	. . .
Texas	274	130	15	20	98	11	1,244,108	10,068	12,244	40	2	1	1	36	2,081	2,301
Dist. 1	29	16	0	0	13	0	64,467	695	731	6	0	0	0	6	259	211
Dist. 2	11	2	2	1	6	0	72,292	476	517	1	0	0	0	1	116	154
Dist. 3	12	3	2	0	7	0	105,537	780	775	3	0	0	0	3	147	151
Dist. 4	26	4	1	6	15	0	137,665	696	847	7	0	0	0	7	197	206
East	24	13	4	0	7	0	143,389	808	774	3	1	0	0	2	169	150
Dist. 7-B	41	15	1	6	19	0	124,731	1,465	1,679	11	0	0	0	11	423	439
West	71	45	2	1	16	7	371,819	2,648	3,770	4	0	1	1	2	409	525
Dist. 9	38	20	3	0	12	3	120,820	1,837	2,299	4	1	0	0	3	319	394
Dist. 10	22	12	0	6	3	1	103,389	663	852	1	0	0	0	1	42	71
Utah	4	4	0	0	0	0	22,977	165	201	0	0	0	0	0	55	54
West Virginia	4	0	0	4	0	0	11,513	490	494	0	0	0	0	0	4	18
Wyoming	26	11	0	0	15	0	136,102	664	623	11	0	0	0	11	268	208
Misc. (Ore.)	2	0	0	0	2	0	4,869	94	84	2	0	0	0	2	86	51
Total U. S.	**867**	349	25	62	299	132	3,517,465	28,145	32,043	**148**	12	2	3	131	6,076	6,121
Previous week	980	426	26	92	333	103	3,910,299	. . .	. . .	190	16	2	4	168	. . .	. . .
Cum. 1960	28,145	12,902	841	2,295	10,848	1,259	120,186,521	. . .	. . .	6,076	541	68	194	5,273	. . .	. . .
Cum. 1959	32,043	16,209	781	2,316	11,898	839	133,007,089	. . .	. . .	6,121	580	82	184	5,275	. . .	. . .
Western Canada	56	32	0	5	13	6	364,142	1,468	1,617	12	1	0	1	10	398	459

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	8-13-60	8-6-60	8-15-59
Pennsylvania	2,302	2,303	2,631
Other Appalachian	1,710	1,795	1,956
Illinois, Indiana, Michigan	9,247	9,650	9,974
Nebraska and North Dakota	2,914	2,922	2,910
Kansas	8,568	8,805	9,797
Oklahoma	16,324	16,541	16,315
Arkansas	1,805	1,814	2,124
Louisiana	18,232	18,024	19,243
North	3,058	3,246	3,368
South	15,174	14,778	15,875
Mississippi, Alabama, Florida	2,472	2,367	2,688
New Mexico	8,258	8,510	7,837
Texas	99,679	100,613	113,874
East Texas	8,015	8,174	8,837
West Texas	46,921	46,616	53,662
Texas Gulf	16,780	17,001	19,902
Other Texas	27,963	28,822	31,473
Wyoming	16,534	16,857	15,573
Other Rocky Mountain	9,421	9,565	9,724
California	26,819	27,222	31,763
Foreign	†14,394	14,175	15,439
Total	**238,679**	241,163	261,848

*Bureau of Mines. †Includes 3,507,000 bbl. in California.

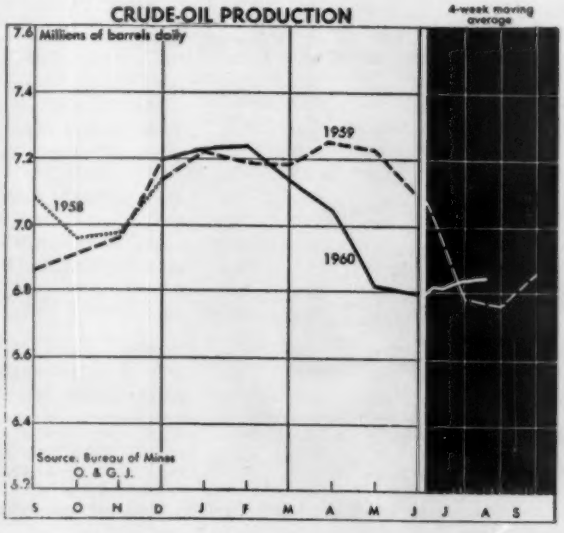
DAILY AVERAGE PRODUCTION FOR WEEK

	August 20, 1960 Crude oil	Lease condensate	Total	Aug. 13 total
Alabama	17,000	.....	17,000	16,100
Arkansas	82,050	250	82,300	82,100
California	837,800	.....	837,800	838,100
Colorado	130,275	.....	130,275	128,900
Eastern	39,700	.....	39,700	40,500
Florida	1,000	.....	1,000	1,000
Illinois	218,400	.....	218,400	216,400
Indiana	33,000	.....	33,000	32,600
Kansas	†298,040	.....	†298,040	†290,875
Kentucky	65,600	.....	65,600	63,400
Louisiana	945,975	120,800	1,066,775	1,066,275
North	105,700	5,800	111,500	111,000
South	840,275	115,000	955,275	955,275
Michigan	41,200	.....	41,200	39,500
Mississippi	131,575	3,450	135,025	135,025
Montana	82,000	.....	82,000	83,000
Nebraska	68,200	.....	68,200	68,000
Nevada	100	.....	100	100
New Mexico	288,275	6,700	294,975	294,975
North Dakota	66,800	.....	66,800	66,100
Oklahoma	†491,300	.....	†491,300	†486,100
Texas	2,352,575	85,250	2,437,825	2,437,825
Dist. 1	41,000	2,500	43,500	43,500
Dist. 2	96,300	8,100	104,400	104,400
Dist. 3	309,275	36,000	345,275	345,275
Dist. 4	164,575	14,450	179,025	179,025
Dist. 5	26,000	300	26,300	26,300
Dist. 6	104,575	9,800	114,375	114,375
East Texas field	122,000	.....	122,000	122,000
Dist. 7-B	127,425	125	127,550	127,550
Dist. 7-C	111,000	3,250	114,250	114,250
Dist. 8	950,425	8,000	958,425	958,425
Dist. 9	193,000	1,800	194,800	194,800
Dist. 10	107,000	925	107,925	107,925
Utah	101,740	.....	101,740	89,300
Wyoming	349,250	.....	349,250	351,000
Others	‡1,525	.....	‡1,525	‡1,375
Total U. S.	6,643,380	216,450	**6,859,830**	6,828,550
Change from prev. week, up		.....	**31,280**	.....
Canada	†543,905	.....	†543,905	†475,386

Total U. S. Prod.—Jan. 1-Aug. 20 ..... 1,630,215,600 bbl.
Same period last year (crude plus cond.) ..... *1,647,940,500 bbl.

*Includes 43,610,250 bbl. condensate. †Week ended previous Monday. ‡Alaska, South Dakota, and Arizona.

CRUDE-OIL PRODUCTION



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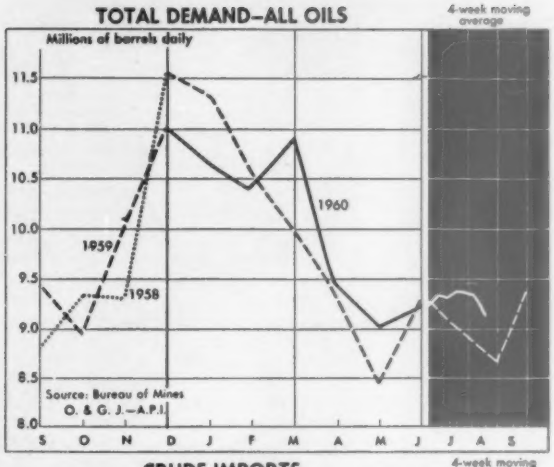

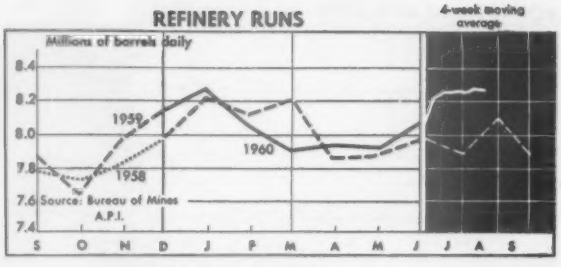

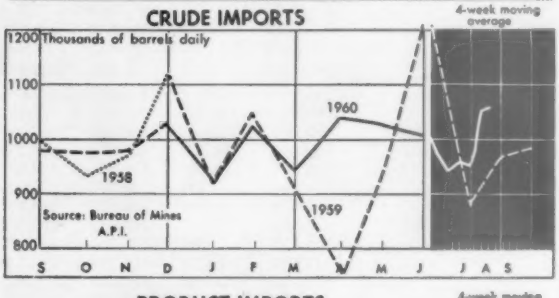

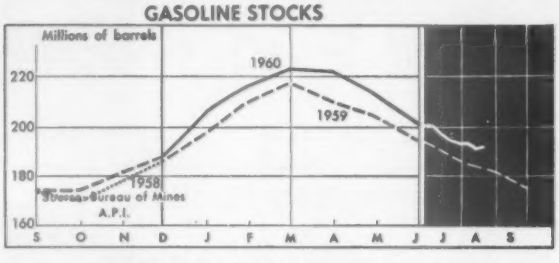

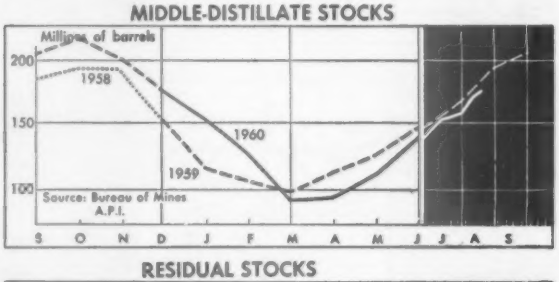

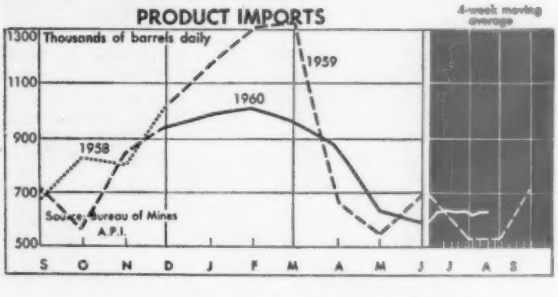

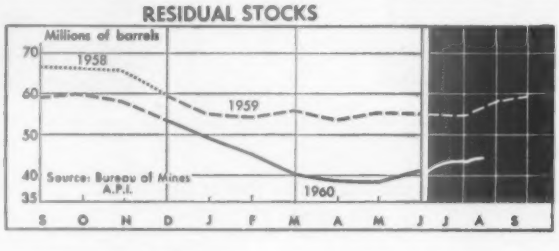

API REFINERY REPORT—AUGUST 19, 1960

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, August 1959 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,089	552.1	26.9	333.3	117.4	44,519	11,866	51,949	11,897	1,150	547.8	27.0	328.3	146.8
Appalachian:														
District 1 ...	93	40.0	4.4	21.0	6.1	5,904	689	3,273	437	93	41.2	2.7	21.8	6.0
District 2 ...	108	58.3	1.3	23.4	10.3	3,178	412	1,475	287	105	58.9	1.6	18.8	8.5
Ind., Ill., Ky. ..	1,500	811.5	67.4	336.1	114.8	33,527	6,469	25,180	5,484	1,436	772.0	53.8	298.9	125.2
Minn., Wis., Dak.	133	60.4	9.3	34.4	17.0	6,102	1,509	7,309	623	102	50.7	2.8	27.6	9.9
Okla., Kans., Mo.	764	418.6	13.0	182.7	19.6	16,975	1,698	12,119	1,027	719	393.3	7.0	175.2	18.9
Inland Texas ..	289	215.4	6.7	46.9	17.0	6,745	587	1,446	2,500	306	226.7	7.2	52.0	21.8
Tex. Gulf Coast	1,808	980.5	129.5	448.0	114.6	25,128	3,361	15,508	4,928	1,843	958.3	77.3	446.3	168.9
La. Gulf Coast .	699	350.7	58.1	168.1	53.3	10,767	2,072	6,728	1,551	717	385.0	48.0	172.3	51.0
N. La. and Ark.	111	74.4	2.6	26.4	7.0	5,117	919	1,871	164	67	27.3	2.0	13.6	5.1
Rocky Mountain:														
New Mexico .	26	12.7	0.4	4.7	3.3	651	51	157	4	27	14.1	0.4	5.5	2.0
Other Rky. Mt.	316	148.9	2.4	71.4	37.0	5,432	357	2,821	844	318	148.2	2.0	62.9	34.0
West Coast	1,199	486.1	27.3	174.6	286.3	28,265	1,378	13,995	14,568	1,198	542.4	2.5	180.7	285.5
Aug. 19, 1960	8,135	4,209.6	349.3	1,871.0	803.7	192,310	31,368	143,831	44,314	8,081	4,165.9	234.3	1,803.9	883.6
Aug. 12, 1960	8,335	4,287.9	403.3	1,902.0	870.0	191,838	31,224	140,647	43,969	.....	.....	.....	.....	.....
Aug. 21, 1959	8,214	4,188.0	294.1	1,885.3	891.6	181,422	29,948	153,684	56,067	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.76	....	....	....	....	....	....	....	....
15-15.9	1.84	....	....	....	....	....	....	....	$1.81
16-16.9	1.92	....	....	....	....	....	....	....	1.86
17-17.9	2.00	....	....	....	....	....	....	....	1.91
18-18.9	2.08	....	....	....	....	....	....	....	1.96
19-19.9	2.16	....	....	....	....	....	....	....	2.01
20-20.9	2.24	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.32	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.39	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.23-3.53
Van	3.08
Pennsylvania Grade:	
Bradford	$4.75-4.80
Middle District	4.52
Southwest Pennsylvania	4.25
West Virginia	4.17
Buckeye Grade	4.08
Illinois Basin	**2.85-3.00**

Foreign

Middle East, Persian Gulf: (cargoes f.o.b. lifting port)	
Arabian, 34.0-°-34.9, Ras Tanura	$1.76-1.80
Iranian, 34.0°-34.9°, Bandar Mashur	1.74-1.78
Iranian, 34.0°-34.9°, Abadan	1.69-1.73
Iraq, 35.0°-35.9°, Fao	1.68-1.74
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.58-1.59
Qatar, 41.0°-41.9°, Umm Said	1.91-1.93
Middle East, E. Mediterranean:	
Arabian, 34.0°-34.9°, Sidon	$2.13-2.17
Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli	2.15
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.57
Canada:	
Leduc-Woodbend	$2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumarebo, 47°-47.9°, Tucupido	3.34
San Joaquin, 40°-40.9°, Puerto La Cruz	3.08
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

★ Gulf-NY, clean (ATRS+12.5%)	$3.21
★ Gulf-NY, dirty (ATRS—5.0%)	2.71
★ Carib.-NY, dirty (ATRS—57.5%)	1.17
PG-UK, dirty (Scale—62.5%) (24s. 2d.)	3.39

★Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):	
Regular (91 octane)	12.25-12.50
Premium (99 octane)	15.00-15.25
Natural gasoline (26-70)	4.5
Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	11.00
Regular (92 octane)	11.25
Premium (98 octane)	12.25
California (rack) Los Angeles:	
Regular (88 octane)	11.65-12.15
Premium (94 octane)	12.65-13.15
Premium (100 octane)	14.00-14.65
Caribbean area (cargoes):	
Regular (87 octane)	10.125-10.25
Premium (97 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):	
Kerosine 42-44	10.125-10.375
Diesel oil (58 d.i. and above)	9.75-10.00
Distillate No. 1	9.75-10.00
Distillate No. 2	8.75-9.00
Gulf Coast (cargoes):	
Kerosine 41-43	9.00-9.25
Distillate No. 2	8.25
New York Harbor (barges):	
Kerosine 41-43	10.05
Distillate No. 2	9.05
Diesel fuel, 48-52 d.i.	9.35
Caribbean area (cargoes):	
Distillate No. 2	8.125

Residual Fuel (Bbl.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.90
Gulf Coast (cargoes):	
Bunker C fuel	2.35
New York Harbor (barges):	
Bunker C fuel	2.52
Caribbean (cargoes):	
Bunker C	$2.10
California (rack):	
Bunker C fuel, Los Angeles	$2.15

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OIL WELL Derrick, Cantilever, 128', 450,000 lb. test, 4 sheave Crown, 24' x 38' x 5' substructure, located Minot, N. D. Sacrifice $3,500.00, Luke Wise, Community Gas & Oil Co., Billings, Montana.

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40,000' 6⅝" OD x .219" wall, 1400# test, $1.24 ft., fob Houston

Some road crossing casing also available.

Will deliver free to coating and wrapping plants in Houston; or, if desired, will store for reasonable time.

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FOR SALE EQUIPMENT

USED TANKS, Pumps, Valves, Casing, Line Pipe located Sand Springs, Oklahoma and Kansas City, Kansas. Box L-954, The Oil and Gas Journal.

FOR SALE—Practically New—205, 20" x 5' Vertical, 500# WP B.S. & B Separator with valves, Price $1,100.00. Also a 70 B2-8-2-3 Indirect B.S. & B Indirect Heater, Double Pass, Adjustable Chokes, Price $800.00. Oppenheim & Briscoe, 1107 Merc. Secs. Bldg. Dallas, Texas, Telephone RI 8-3898.

ONE—97½ H.P.—500 series motor—80 stage—54 series Reda pump complete with 3,300 ft. #2 cable. Jenkins-Ray Supply, Box 967, Ponca City, Okla.

ENGINES: 3—230 H.P. Clark Twin Engines. 1—80 H.P. Cooper Bessemer Engine. 1—32' x 100' x 10' Steel Frame Galv. Iron Building. All engines, complete and in excellent condition, Building top quality. Located in southern Oklahoma. Priced to sell. Contact A. G. Bartlett. Phone RIverside 2-7191, Box 7307, Tulsa, Oklahoma.

SKIDMOUNTED COMPRESSER UNITS FOR SALE OR FOR LONG AND SHORT TERM LEASING.

New—Used—or Rebuilt Units. Several now in stock, for gas lifting, vacuum, in situ, air drilling, and gas gathering services.

BENZ ENGINEERING
Box 29 Montebello, Calif. PA 1-3611

OILWELL DRAWWORKS

Oilwell "96" drawworks with Goster air master breakout cathead, 1⅜" Lebus grooves and Foster Junior spinning cathead. Mfr.'s #H14D-39. Inspect by contacting Mr. W. O. Foster at Humble's office at Intracoastal Terminal, Harvey, La. Mail bids to Mr. Westbrook Teer, Humble Oil & Refining Co., Box 2180, Houston 1, Texas. Humble reserves the right to reject any and all bids.

HUMBLE OIL & REFINING COMPANY

FOR SALE EQUIPMENT

FOR SALE—One new 11½ inch Varel tricone Rock bit $175.00. Herbert M. Stanley, 4221 Arcady, Phone LA11206 Dallas.

TRADE 1,723 ACRES ranch and city propperties for equipped rigs. Bryan Edwards, 1018 Texas Ave., Phone 3-1672, Lubbock, Texas.

FRANKS 2000 PORTABLE rotary. A-1, all tools and equipment. Karchmer Pipe & Supply, Centralia, Ill.

REDA PUMP, 40% of new price, 60 H.P. motor just rebuilt, 147E pump, 86 stages, rated at 1885 B/D against 1670' head. For 6⅝" casing or larger. 3,000' of cable & all accessories. P. O. Box 407, Riverdale, Calif., TOwnsend 7-3594.

SEISMIC EQUIPMENT—Two Electro-Tech DS-7 magnetic tape recorders equipped for record and/or playback. In good condition with only 18 months total use. Box L-912, The Oil and Gas Journal, Tulsa, Oklahoma.

TWO PERFORATING trucks with lines completely equipped with or without radioactivity logging equipment. These trucks are in excellent condition and ready for immediate use. Box L-897, The Oil and Gas Journal, Tulsa, Oklahoma.

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9MM BTU/HR. Duty; 20' Stack
7MM BTU/HR. Duty; 44' Stack
2MM BTU/HR. Duty; 36' Stack
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60 East 42nd Street; New York 17, N. Y.
310 Thompson Building; Tulsa 3, Okla.

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2,000,000 ft.	2"	3.50# to the ft.
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500,000 ft.	6"	19.80#
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400,000 ft.	10¾"	35#
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10,000 ft.	16"	42#

All No. 1 Grade plain end and cleaned.
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P. O. Box 5412 Shep. Sta.
Columbus 19, Ohio
Phone CL 3-5527

FOR SALE EQUIPMENT

SEISMIC INSTRUMENTS—Three sets of Century 501 recording instruments either truck mounted or rigged for lab. use. Box L-911, The Oil and Gas Journal, Tulsa, Okla.

3—INTERNATIONAL K11 tandem trucks equipped with triplex HP acid pumps, tanks, flexible hose and connections. These pumpers excellent for many lease service operations. Selling price based on salvage value, $5000.00 and up. Terms or lease purchase for qualifying buyers. Write or call C. D. Core, P. O. Box 47, Phone FR 9-5132, Seguin, Texas.

TRAILER MOUNTED Double Drum Rotary Drilling Rig Complete. Ideal for 2,000 to 4,000 foot drilling. R. A. Tidwell, Box 4423, Oklahoma City, Okla. OR 7-4949.

FOR SALE: Hopper double drum hoist, Mercury motor, pole, sandline, 3-axle drive truck. $3,950. Hopper double drum hoist on skids, 145 GK Waukesha engine, sandline. $5,950. Hopper double drum hoist on skids, no engine. $1,750. Hopper single drum hoist on skids, no engine. $450. Rotary attachment for Hopper hoists. $750. Hopper portable drilling and workover rig, with drilling line, sandline, blocks, hook, 90 ft. mast, subbase, two trailers. $9,850. Wagner-Morehouse portable drilling and workover rig, with torque converter and air clutches, trailer, drilling line, sandline, blocks, hook, 96 ft. mast, subbase. $45,000. Terms. 1705 Burton Way, Bakersfield, Calif.

EQUIPMENT WANTED

WANTED TWO or more 6¾" drill collars. D. W. Falls, Inc., P. O. Box 8087, STA. C, Albuquerque, N. Mex.

USED REFLECTION seismic instruments with magnetic tape, or used tape for installation with S.I.E. instruments. Please itemize pertinent data. Box L-972, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED HYDRAULIC Casing Pulling Machine. Send details. Luke Wise, Community Gas & Oil Co., Billings, Montana.

WE ARE interested in the purchase of your depleted wells for salvage. Also, used casing, tubing, units, tanks, etc. Must be in Kansas area. The Buckeye Supply Company of Kansas, Inc., 105 S. Main, El Dorado, Kansas.

HELP WANTED

NEW OIL JOB Directory, foreign and domestic, showing where to apply for jobs. 500 selected producing, refining, butane and pipeline companies. Nationwide, $5.00 cash. OIML Co., Box 2603, Tulsa, Oklahoma.

LIQUIDATION AT ESSO STANDARD OIL REFINERY, BATON ROUGE

400 HP Compressors; Towers; Vessels; Heat Exchangers; Pumps.

For further information contact:

Chemical & Refinery Equipment Co.
Box 19351, Houston, Texas
Phone HO 8-1317

OR

Louisiana Steel Compress Co.
Box 566, Baton Rouge, La.
Phone DI 8-5571

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DESTREHAN, LA.

HEAT EXCHANGERS

Steel Tube: 3280, 2100, 1200, 930 sq. ft.
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20 Fin Tubes: 50-190 sq. ft.

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8' x 75' 20 Tray 25#	4' x 36' packed 210#
7½' x 56' 20 Tray 35#	10' x 55' 60#
3' x 58' 30 Tray 154#	8' x 43' 60#
3' x 47' 20 Tray 120#	6' x 42' 200#
18" x 32' 15 Tray 130#	6' x 20' 40#
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Hot Oil: 1"-6"; 50-400 gpm 100-3,000 ft. hd.
Boiler Feed: 190 gpm 1,500' hd.
Cooling Tower: 7,000 gpm 120' hd.
River Water Sump: 1,000 gpm 59' hd.

STORAGE TANKS & SPHERES

15 Storage Tanks welded: 29,000, 10,000, 5,000, 3,750 barrel.
5 Spheres-Spheroids: 5,000, 10,000 barrel.

1—Carrier 853 ton refrigeration Compressor Turbine drive. (1953)
2—IR Turbo Exhausters 15,300 & 17,000 CFM 4.85 PSIG with Turbine Drives.
1—Clark Centrifugal Compressor 10,000 CFM—240 PSI discharge. (1953)

OTHER FEATURED ITEMS

1 Lummus: 35 mil. BTU furnace
2 Petro-Chem. Furnace: 1¼ mil. & 8 mil. BTU
2 B&W Boilers: 70,000# per hr.-450#
1 IR-XVG-4 Compressor
1 Worth LT-6 Compressor

WIRE!—PHONE! FOR COMPLETE INFORMATION

BRILL EQUIPMENT COMPANY—DESTREHAN, LA.—NORCO 6571
4101 San Jacinto St. Houston 4, Texas, JA 6-1351
35-65 Jabez St. Newark 5, N. J., MA 3-7420

CHEMICAL ENGINEER

Large independent Oil Company has permanent position in natural gasoline plant in California for young engineer with ChE degree. Excellent working conditions. Salary commensurate with background and experience. Send complete resume: All replies confidential.

Box 31 R 647
The Oil and Gas Journal
4041 Marlton Ave.
Los Angeles 8, California

WANTED

Top, Executive Type, Construction Manager for full charge of going concern. Capable of Supervising Personnel and Projects on Industrial, Public Works and Commercial Jobs. Must have administrative ability, familiar with cost accounting, analyzing bids, and know construction methods and procedures. Send full resume of work experience, education, reference and salary expected. Outstanding opportunity for future growth. Located in the Louisiana-Mississippi-Arkansas area.

All replies held in confidence.

Reply to: BOX L-976
THE OIL AND GAS JOURNAL
TULSA, OKLAHOMA

HELP WANTED

WANTED — Manufacturers Representatives, West Texas and Dallas Areas. Well known competitive tool-joint compound and drilling rig cleaner. Box 1057, Gardena, Calif.

RESEARCH GEOPHYSICIST. Ph.D. level or equivalent with background in seismic techniques. Opportunity to make original contributions to active research program. Location, Tulsa. Sinclair Research Laboratories, Inc., P. O. Box 3006, Tulsa, Oklahoma.

PETROLEUM ENGINEER—with refinery process experience, wanted for permanent position with aggressive, independent oil company, located in Southern California, 20 minutes from heart of Los Angeles. Salary to start $700.00 per month and up, depending on qualifications. All replies confidential. Powerine Oil Company, 12354 East Lakeland Road, Santa Fe Springs, Calif.

DRILLING ENGINEERS and Toolpushers with air drilling experience. Top men needed for challenging recurring short-term overseas assignments. Good pay and bonus for results. Send resume to: International Air Drilling Company, 2509 West Berry, Fort Worth 9, Texas.

EXPANDING OILWELL Equipment Manufacturer has several opportunities for qualified salesmen with knowledge of production and marketing problems in Oil Industry desired. Compensation plan based on salary plus commission. Please send resume including educational background and experience to P. O. Drawer 1150, Beaumont, Texas.

PETROLEUM ENGINEER with field production experience wanted to manage as substantial owner of operating company, oil and gas leases in Kansas. Wonderful opportunity for qualified man, with lifetime future. Should have excellent references with actual field experience as well as management ability to supervise. Prefer man with experience in Kansas production. Age no factor, but prefer man from 35 to 45 years of age. Write full resume in first letter; all replies held confidential. Apply by letter to: Box L-944, The Oil and Gas Journal, Tulsa, Oklahoma.

SENIOR PROCESS ENGINEER, degree in Chemical Engineering, with design experience plus minimum of 10 years in refinery or chemical plant operations. Outstanding opportunity in supervisory capacity for qualified man. Travel approximately 25% away from Home Office. Salary—about $12,000/year. Headquarters—West Coast. Box L-960, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY SUPERINTENDENT

or operator for small well established midwestern plant. Age 30 to 50. Must relocate at company expense. Excellent opportunity and salary for aggressive and experienced man. Write full qualifications and details to:

Box L-975, The Oil and Gas Journal
Tulsa, Oklahoma

REFINERY OPERATING FOREMAN

Should be familiar with FCC, HF Alkylation and Reforming Units. Growing company with excellent benefits.

Box L-958, The Oil and Gas Journal
Tulsa, Oklahoma

PETROLEUM ENGINEER WANTED

This is an opportunity for a man to become an officer of an established producing company, and calls for a high level man. In this position you would call on individuals who may be interested in investing funds in our oil properties. This will take you out not to exceed one-half your time. The other one-half your time would be spent in petroleum engineering.

Please give full particulars of qualifications and experience and reply to:

Box L-964, The Oil and Gas Journal
Tulsa, Oklahoma

SITUATIONS WANTED

PETROLEUM ENGINEER: B. S. Degree, Age 28. Three years employed as field engineer. Experience as roustabout and roughneck. Seeking job as engineer or production supervisor. Resume on request. Box L-947, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST (M.S.) desires foreign employment. Ten years experience, two in Europe. 33, married, speaking knowledge of Italian and Spanish. Capable of organizing and managing exploration program. P. O. Box 449, Midland, Texas.

PRODUCTION SUPERVISOR, graduate engineer, benched at age 53 due to sale properties. Good health. Cost conscious. Long experience in production work. Compressor operation, small gasoline plant. Would like salaried job or contract operation of properties. Box, L-957, The Oil and Gas Journal, Tulsa, Oklahoma.

LAND CLERK—Retiring next October, legal education, perfect health, long experience leasehold records, contracts, division orders and related matters, desires employment small company or individual operator. Box L-949, The Oil and Gas Journal, Tulsa, Oklahoma.

PIPELINE ENGINEER—13 years experience pipeline economics and design in refined products, crude oil and natural gas pipelines. 37 years of age. B.S.M.E. Complete Resume on request. Box L-951, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST MS 1949—Experienced in management, research, subsurface, surface, photogeology, some mining. 5 years major company. Last 6 years operating own business. Desires change. Domestic or foreign. Box L-961, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, SEVENTEEN years varied major and independent experience, thirteen in West Texas-New Mexico. Good oil finding record. Desires retainer for generating and screening drilling deals. Box L-973, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, B.S., ten years extensive experience in all phases waterflood operations, evaluations, field management, now employed. Desires responsible position with reliable, aggressive independent. Box L-968, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION MANAGER, P. E. graduate, married. With majors, independents, and consulting for 14 years. Wide experience in well completions, workovers, reserve estimates, and property management. Would like position with responsibility and opportunity, or management contract properties. Dallas resident but willing to relocate. Box L-969, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST: 41, American, B.S. Mining Engineering. 19 years experience—16 years foreign work in Venezuela and Colombia. 9½ years administrative experience in Geophysical-Geological co-ordination with major independent. At present consulting. Seeking assignment in foreign work, preferably Central or South America. Will consider permanent position with future potential. Complete resume and references upon request. Apartado 4777 del Este, Caracas, Venezuela.

ROYALTIES

NOTICE INVESTORS, offering income producing Gas-Distillate royalty under 5 new, deep, dual completed, Frio sand wells on the Gulf Coast. Ogden Oil Company, P.O. Box 409, Ph. EL 2-3352, Taylor, Texas, Ph. HI 2-2471, Austin, Texas.

BUSINESS OPPORTUNITIES

ESTABLISHED, responsible manufacturer with national sales and service organization wants products to be sold to oil, gas and allied supply industries. Equipped for manufacture, direct sales representation, distribution and warehousing. Proposals will be answered promptly. Box L-948, The Oil and Gas Journal, Tulsa, Oklahoma.

FINANCIAL—Investment Banking Houses and Underwriters reached. Confidential. You can send the details of your proposition direct or thru your attorney to Consultant 817—51st Street, Brooklyn, N. Y.

MANUFACTURER'S REPRESENTATIVE

WEST TEXAS, Dallas area representatives calling on drilling contractors. Add fast selling tool-joint compound and rig cleaner through supply houses. P. O. Box 1057, Gardena, Calif.

PRODUCTION WANTED

AN INDIVIDUAL desires to buy 75 to 100 barrels of good settled production. Will pay the highest price, all cash. Please write to Milton Gessner, Laconia Building, Wheeling, W. Va.

WANTED TO BUY: Producing or non-producing minerals and/or ORRs in the San Juan Basin, NW N. Mex. Box L-936, The Oil & Gas Journal, Tulsa, Oklahoma.

BUSINESS SERVICE

DELAWARE CORPORATIONS formed and serviced. American Guaranty & Trust Company, P. O. Box 487, Wilmington, Delaware.

LEASE AND DRILLING BLOCKS

FOR SALE—Working interest in 80 acres. Near production, quick payout. Well 750 ft. Eastern Kansas. Box L-970, The Oil and Gas Journal, Tulsa, Oklahoma.

PROVEN LOCATIONS to drill, market, substantial reserves. Box L-974, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE Approximately 1,000 acres in eastern Kentucky, old producing oil field with five wells producing. 24W Bucyrus rig in good condition with tools. Jacks & trucks etc. Will sacrifice all for $15,000, because of being forced to take over other business. Northwestern Drilling Company, 811 So. 3rd St., Louisville Ky.

15 STRIPPER WELLS 230—920 feet, 200 acre lease Comanche County. Needs waterflood. All interests $15,000. Carl Bergman, 729 North 17, Lawton, Oklahoma.

185 ACRES: Seminole County, Okla., one Hunton Lime producing well. Adjacent to production. Priced reasonably. Box L-953, The Oil and Gas Journal, Tulsa, Okla.

WORKING INTEREST—KENTUCKY

22 wells on 4 leases. Sacrifice for $50,000.00 original investment. Cash needed. Box L-955, The Oil and Gas Journal, Tulsa, Oklahoma.

40 ACRES—Eastern Kansas with 4 proven inside locations Bartlesville Sand 715 ft. ⅜ths for sale, $400.00 per ⅛th. Reply: Box L-967, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL VENTURE IN MIDDLE TENNESSEE

1,600 acres west flank Cincinnati Arch, leased by responsible parties. Good geophysical data. 9 possible pay zones. Shallow production anticipated. Want financing to drill and complete first well. Will exchange bank references.

BRIANS AND RICHARDSON
311 Peoples National Bank Bldg., Tyler, Texas

AREA FOR CONCESSION

Quaiti and Kathiri Governments in the Eastern Aden Protectorate invite applications from oil companies for a concession or concessions to explore for and exploit oil in an area of about 5,000 square miles of desert in the region of Thamud (about 17° 20′ North 49° 55′ East). Oil companies who wish to be considered should submit their applications to: The State Secretaries, Quaiti and Kathiri Governments, c/o the Protectorate Secretary, the Secretariat, Aden.

LEGAL

SALE OF OIL AND GAS MINING LEASES, TRIBAL AND ALLOTED INDIAN LANDS. Department of the Interior Bureau of Indian Affairs, Uintah and Ouray Agency, Fort Duchesne, Utah.

SEALED BIDS will be received until 2:00 P.M. Mountain Standard Time, September 7, 1960, and opened at that time in the office of the Uintah and Ouray Agency, Fort Duchesne, Utah, for the leasing of 940.92 acres of Tribal Indian lands, and 10,428.38 acres of allotted Indian lands, located in Townships 8, 9 and 11 South, Ranges 19, 20, 21 and 22 East, Salt Lake Meridian, Uintah County, Utah, for oil and gas mining purposes. Details of the lease offering and how and where to file bids may be obtained by addressing an inquiry to the Superintendent, Uintah and Ouray Indian Agency, Fort Duchesne, Utah.

(Continued from page 138)

Sur. IPF 38 BOPD, open hole. TD 4,539 ft. New oil discovery.

Sun Oil Co. 1 Houston Farms, BB&C Sur., A-445, 11 miles southeast of Chocolate Bayou. Shut-in gas well, no gage, perf. 15,986-95 ft., Frio. TD 18,012 ft. New-field discovery 2 miles northwest of Alligator Point field in Rattlesnake Mound area.

TEXAS GULF COAST

Calhoun County:

Tennessee Gas Transmission Co. 1-C Maude B. Traylor, Juan Maldonado Sur., A-120, 4 miles southeast of Point Comfort. AOF 5,646 M.c.f.d., GLR 5,440 cu. ft. per bbl., 52°, shut-in TP 7,037 psi., perf., 10,630-45 ft., Frio. TD 14,490 ft. New-field discovery—South Point Comfort.

Chambers County:

H. E. Williams and Texas Pacific Coal & Oil Co. 1 Barber Estate, Chambers County School Land Sur., A-322, 5 miles southast of Mount Belview. IP 1 M.M.c.f.d., 18 BCPD, 10/64-in., TP 1,950 psi., perf. 7,550-56 ft., Frio. TD 8,260 ft. New-field discovery.

J. P. Petkas et al. 1 E. E. Barrow, Solomon Barrow Sur., A-3, 5 miles southeast of Mount Belview. AOF 8 M.M.c.f.d., GLR 58 M.c.f. per bbl., 58.3°, shut-in TP 2,560 psi., perf. 7,236-40 ft., Frio. TD 8,321 ft. New pay in Petkas field.

J. P. Petkas et al. 2-A E. E. Barrow, Solomon Barrow Sur., A-3, 6 miles southeast of Mount Belview. IP 15 BOPD and 24 M.c.f.d., 7/64-in., 41°, TP 1,200 psi., perf. 6,752-56 ft., Frio. TD 8,250 ft. New pay in Petkas field.

Goliad County:

Sunray Mid-Continent Oil Co. 5 E. R. Pereira, Block 5, V. Ramos Sur., A-241, 12 miles east of Pettus. AOF 24 M.M.c.f.d., dry gas, shut-in TP 1,230 psi., perf. 2,981-85 ft., Vicksburg. TD 5,200 ft. New pay in Hordes Creek field.

Hardin County:

Sinclair Oil & Gas Co. et al. 6 J. A. Vickers Fee, J. A. Vickers Sur., A-52, 3 miles northwest of Silsbee. AOF 2,560 M.c.f.d., GLR 21.2 M.c.f. per bbl., 61.4°, shut-in TP 2,218 psi., perf. 7,342-48 ft., Yegua; 144.50 BOPD, 8/64-in., 42.1°, GOR 703 cu. ft. per bbl., TP 1,050 psi., perf. 6,941-48 ft., Yegua; and AOF 8,600 M.c.f.d., GLR 36.3 M.c.f. per bbl., 54.8°, shut-in TP 2,403 psi., perf. 6,681-86 ft., Yegua. TD 11,075 ft. Discovery well of Dry Creek field.

Jefferson County:

Meredith & Co. 1 Mixon Land Co., Silas Meador Sur., A-180, 4 miles northwest of Fannett. IP 215.28 BOPD, 9/64-in., 35.5°, GOR 792 cu. ft. per bbl., TP 790 psi., perf. 8,230-34 ft., Frio. TD 9,467 ft. New-reservoir and extension discovery a mile west of Gilbert Ranch field.

Orange County:

Gulf Oil Corp. 3 Miller-Vidor Land Co. et al. Unit 2, John V. Swisher Sur., A-316, 2½ miles north of Vidor. IP 26.24 BOPD, 6/64-in., 44°, GOR 8,870 cu. ft. per bbl., TP 1,450 psi., perf. 13,102-120 ft., Frio. TD 13,600 ft. New-field or extension discovery 1 mile south of Vidor field.

Wharton County:

Jocelyn-Varn Oil Co. 1 Ath Carville, Jr., W. D. Ivy Sur. 44, A-514, 6 miles southeast of El Camp. IP 41.23 BOPD, 8/64-in., 25.6°, GOR 1,966 cu. ft. per bbl., TP 1,200 psi., 5,510-12 ft., Frio. TD 5,710 ft. New pay in Duffy field.

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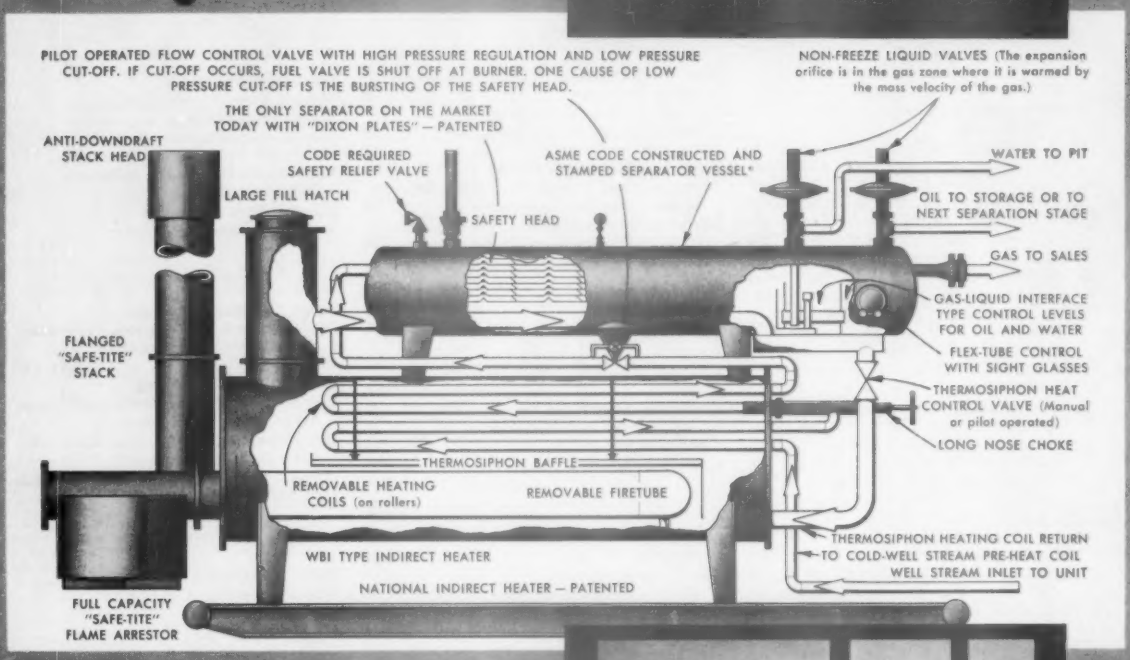
National's All New

THERMOSIPHON STAK-PAK

(PATENT PENDING)

GAS CONDENSATE PRODUCTION UNIT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NON-FREEZE LIQUID VALVES (The expansion orifice is in the gas zone where it is warmed by the mass velocity of the gas.)
THE ONLY SEPARATOR ON THE MARKET TODAY WITH "DIXON PLATES" — PATENTED
ANTI-DOWNDRAFT STACK HEAD
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WATER TO PIT
LARGE FILL HATCH
SAFETY HEAD
OIL TO STORAGE OR TO NEXT SEPARATION STAGE
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GAS-LIQUID INTERFACE TYPE CONTROL LEVELS FOR OIL AND WATER
FLANGED "SAFE-TITE" STACK
FLEX-TUBE CONTROL WITH SIGHT GLASSES
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LONG NOSE CHOKE
THERMOSIPHON BAFFLE
REMOVABLE HEATING COILS (on rollers)
REMOVABLE FIRETUBE
THERMOSIPHON HEATING COIL RETURN TO COLD-WELL STREAM PRE-HEAT COIL
WELL STREAM INLET TO UNIT
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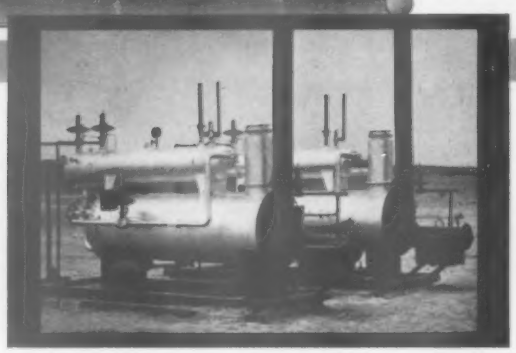
NATIONAL INDIRECT HEATER — PATENTED
FULL CAPACITY "SAFE-TITE" FLAME ARRESTOR



National Thermosiphon Stak-Paks are composed of standard separator and indirect heater units. They are available in combinations of two or three-phase horizontal separators together with any size indirect heater. Completely skid mounted and pre-piped, the ASME code stamped separator is not immersed in the water bath of the heater but is placed above. Glycol protected water bath will not freeze. No housing or insulation needed in moderate climates such as Oklahoma, Kansas and Texas.

The Stak-Pak is available with all controls and valves manufactured by National . . . one supplier — one source . . . non-freeze type liquid valves, FLEX TUBE® liquid level controls, interface level controls, long nose chokes and many others PLUS National's 'Safe-Tite' Flame Arrestors and safety-drilled return bends in heating coils.

For complete information and colored flow diagram on the all-new National Thermosiphon Stak-Pak, contact your nearest National Tank Company branch or write direct to . . .

It's a National®

NATIONAL TANK COMPANY

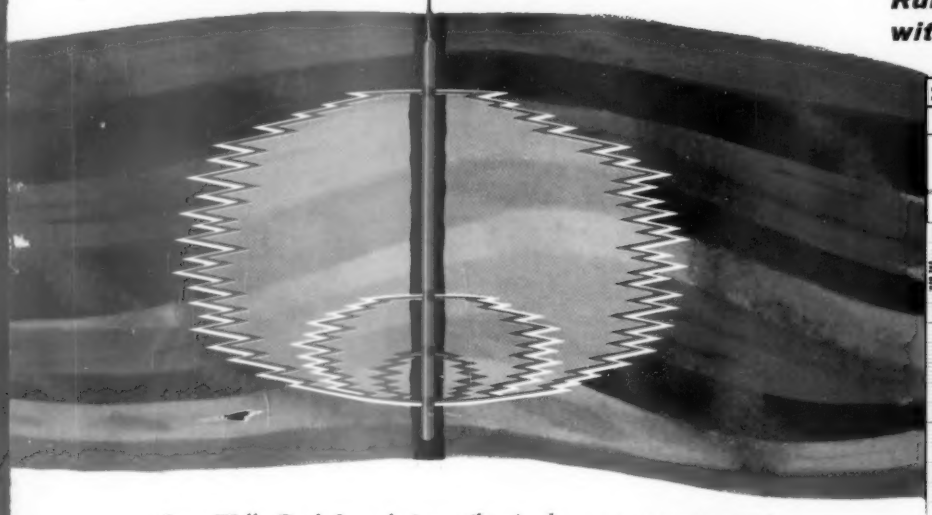
DRAWER 1710

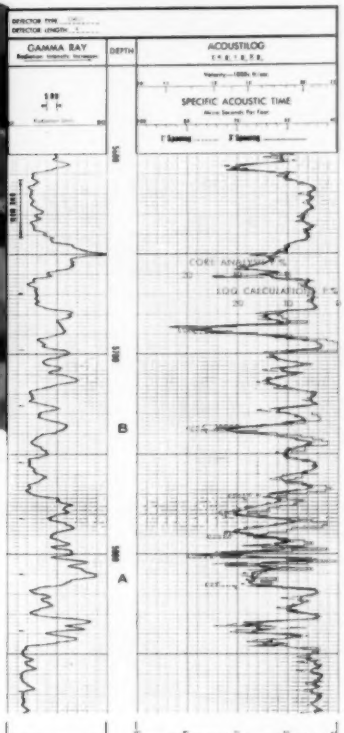
TULSA, OKLAHOMA

Another FIRST by LANE-WELLS

DUAL SPACED ACOUSTILOG*

Run SIMULTANEOUSLY with Gamma Ray or SP





Lane-Wells Dual Spaced Acoustilog is the most accurate, most meaningful, most informative, quickest run log of this type available anywhere. All new instruments, offered exclusively by Lane-Wells, make it possible to run both 1′ and 3′ spacing curves plus either a self potential or a gamma ray curve all on one trip into the well.

Provides Most Meaningful, Most Accurate FORMATION EVALUATION

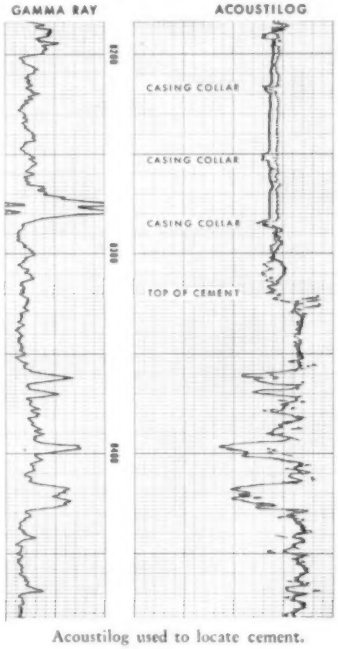
MOST MEANINGFUL!—Because both the 1′ and 3′ curves are recorded while the instrument is in the same position in the borehole, the differences in readings are significant and reliable. Porosities may be read accurately directly from the log. **MOST ACCURATE!** — Exclusive design and circuitry features of Lane-Wells Dual Spaced Acoustilog enable it to measure sound velocities within ±2% of known formation velocities.

PLUS – CEMENT LOCATION

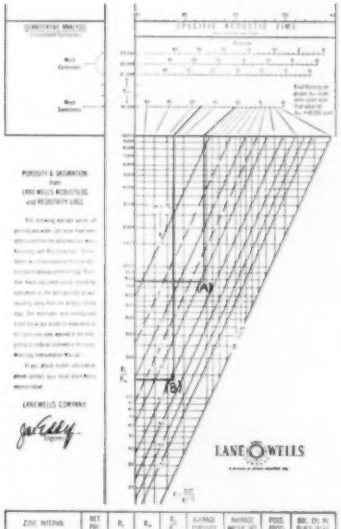
Dual Spaced ACOUSTILOGS have proved remarkably valuable in locating cement and channeling behind casing. Even in areas where other cement locating equipment fails, Acoustilog gets the information.

For complete information about how the all new Dual Spaced Acoustilog can save you money and give you more information about your well, call your nearest Lane-Wells office or write P. O. Box 1407, Houston 1, Texas.

*Lane-Wells Service Mark



Acoustilog used to locate cement.



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IMPORTANT NEW DEVELOPMENT

NOW! You can get Hughes "Flash-Weld" Joints on High-Strength pipe

A process for flash-welding tool joints to HIGH STRENGTH drill-pipe (pipe with a minimum yield strength of more than 80,000 p.s.i.) has been developed by Hughes. Intensive metallurgical research and the close co-operation of the pipe mills were required to solve some of the problems involved.

In developing the new process, HIGH STRENGTH drill-stem assemblies were subjected to repeated fatigue tests, and to a long series of tension-impact drop tests. In the latter, axial impact energy of more than 400,000 foot pounds was applied by the Hughes-built drop tester.

This new HUGHES process produces the ultimate balance in strength and ductility in the weld area.

FLASH-WELD
A DEVELOPMENT OF
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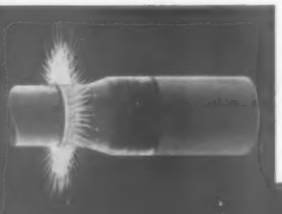

HIGH STRENGTH drill-pipe, unitized with Hughes "Flash-Weld" tool joints, assures you the most dependable drill-stem for extra deep drilling.